SCIENCE

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THE NEW YORK MEETING OF SECTION C OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND THE THIRTY-FIFTH GENERAL MEETING OF THE AMERICAN CHEMICAL SOCIETY—I.

THE meetings were held in the Havemeyer Chemical Laboratory of Columbia University. On Thursday morning, December 27, Section C was organized with Vice-President Clifford Richardson in the chair.

Dr. H. P. Talbot was elected councilor, Dr. J. H. Long, member of the general committee; Dr. Leonard P. Kinnicutt, member of the sectional committee, and Dr. C. E. Waters, press secretary.

Immediately following this, the opening meeting of the American Chemical Society was held with President W. F. Hillebrand in the chair. Two addresses were delivered: 'The Advisability of Restricting the Use of the Ionic Theory in Teaching Qualitative Analysis,' by H. L. Wells, and 'The Chemist and the Community,' by A. D. Little.

In the discussion which followed the second address reference was made to the establishment of the Perkin Chemical

Library, an account of which has already been given in these pages.

At the afternoon session C. F. Mabery, the retiring chairman of Section C, delivered an address on 'The Education of the Professional Chemist.' On Friday morning four of the sections of the Chemical Society held their meetings, at which the following papers were read:

INORGANIC CHEMISTRY

H. L. Wells, Chairman

The Solubility of Lime in Solutions of Nitric Acid: F. K. Cameron and W. O. Robinson.

The complete solubility curves at 25° were given for that part of the system in which the solutions have an alkaline reaction. It was found that there was a curve for solutions in contact with calcium hydroxide as solid phase; a curve for solutions in contact with a series of solid solutions containing lime and nitric acid as solid phase; a curve for solutions where the solid phase had the composition $CaO.N_2O_5.3\frac{1}{2}H_2O$, and a curve when $Ca(NO_3)_2.4H_2O$ was the solid phase. The basic nitrate appeared to be identical with one formerly noted by Werner. It is efflorescent, loses water and breaks down on exposure to the air or more rapidly by washing with alcohol.

The Behavior of Nickel Sulphide toward Hydrochloric Acid and the Qualitative Separation of Nickel and Cobalt from Manganese and Zinc: H. C. Cooper.

Beryllium Nitrate: Charles L. Parsons.

Normal beryllium nitrate, although an article of commerce, has no place in literature. It can only be made by evaporating a solution of beryllium hydroxide or basic carbonate in nitric acid to a thick, gummy and basic mass and dissolving same in a moderate excess of concentrated nitric acid from which it crystallizes as $Be(NO_3)_2 \cdot 4H_2O$ on cooling. The salt loses its nitric anhydride component easily. It melts in its own water of crystallization at 60.5°. It is soluble in alcohol and acetone.

The Instability of Certain Tungstates: R. C. Wells.

By means of the electrical conductivity of their solutions it is possible to follow the transformations which para- and octa-tungstates undergo in water. The latter salts have the formula $M_6W_8O_{27}$ with more or less water of crystallization. The transformations take place more quickly at high temperatures, requiring only about twenty-five minutes to proceed half way at 80°. Not enough data are yet at hand to settle definitely the nature of the change.

Pentavalent Bismuth: Victor Lenher and E. B. Hutchins, Jr.

In making a study of the higher valences of bismuth, it has been found that the tetroxide is fairly stable and that potassium bismuthate and bismuthic acid doubtless exist in a fair degree of purity. In studying the halogen derivatives, the pentoxide on treatment with hydrochloric acid at low temperatures, the treatment of the trichloride with chlorine in a Dewar bulk at liquid-air temperatures and the treatment of the trihalides with various perhalides of cesium yielded only derivatives of the trivalent type.

The Action of Thionyl and Sulphuryl Chlorides on Selenium and Selenium Dioxide: Victor Lenher and H. B. North.

By the interaction of selenium dioxide and thionyl chloride, by the treatment of elementary selenium with thionyl chloride and by the action of sulphuryl chloride on elementary selenium, the tetrachloride of selenium is obtained. On the other hand, selenium dioxide can be sublimed in the vapor of sulphuryl chloride without any reaction taking place.

The Atomic Weight of Hydrogen: WM. A. NOYES.

This work, now in progress at the Bureau of Standards, is in part a repetition of the method used by the author some years ago, when he obtained for the ratio H:O, the values, 15.896 (H = 1) or 1.00654 (O = 16). When corrected for the gases occluded in the copper oxide used as the source of the oxygen, these values become 15.878 or 1.00765. In the recent work the oxygen is weighed as copper oxide, the increase in weight when the hydrogen is passed into the tube is also determined and, besides, the water is weighed separately. In other determinations the hydrogen is first weighed absorbed in palladium, and its weight checked by the increase in weight of the copper oxide tube, as well as by the weight of the water alone. The mean of a number of determinations gives a value which is somewhat higher than Morley's on the oxygen basis. Other experiments are in progress in which no copper oxide is used, the oxygen being passed directly into a tube containing palladium saturated with hydrogen. In this way as much as thirty-five to forty grams of water can be formed in a single determination, thus lowering the probable error.

The Selection of the Most Probable Value for the Atomic Weight of an Element: WM. A. NOYES.

A discussion of the principles which should govern the selection of the atomic weight of an element when a number of workers have determined it in different ways or by the same method. The later determinations should usually have greater weight than the older ones, and in many cases the latter should no longer be used in calculating the mean, especially when sources of error overlooked by the earlier investigators have been avoided in the later work.

The Separation of Calcium and Magnesium: NICHOLAS KNIGHT. (By title.)

Combinations of the Sesquioxides with the Acid Molybdates: R. D. HALL.

A study was made of the compounds containing the various sesquioxides in combination with the acid molybdates with a view of determining whether they were double molybdates or whether they were derivatives of a complex inorganic acid.

The methods employed were: (1) Preparation of other salts by double decomposition, (2) preparation of the free acid, (3) dialysis of the alkali salts. All favored the considering of these salts as derivations of a complex inorganic acid. The following nickel and cobalt derivations were obtained:

$3K_2O \cdot NiO_2 \cdot 9MoO_3$ and $3K_2O \cdot CoO_2 \cdot 9MoO_3$,

analogous to the complex containing MnO_2 in union with MoO_3.

The Direct Quantitative Analysis of Mixtures of Bromides with Chlorides: LAUNCELOT W. ANDREWS.

On the Density Curve of Mixtures of Bromine and Chlorine: LAUNCELOT W. ANDREWS.

The Homogeneity of Tellurium: VICTOR LENHER.

In studying the action of tellurium and tellurium dioxide toward various reagents such as sulphur monochloride, phosphorus oxychloride, antimony pentachloride, etc., in addition to the formation of tellurium tetrachloride or double chlorides, mother liquors were obtained which were carefully tested for tellurium and found by experiment to contain tellurium with an atomic weight of 127.5. Fractional precipitation by means of ferrous salts from the chloride solution gave the figure 127.55. By the slow solution of tellurium in hydrochloric acid, in presence of air, a fraction was obtained, which gave 127.5 as the atomic

weight of tellurium. Three series of atomic weight determinations of tellurium from Bohemia, Cripple Creek and from western copper ores were made. The double bromide of tellurium and potassium was heated in chlorine gas and the potassium chloride weighed. All of the tellurium from these various sources showed an atomic weight of 127.5 and no evidence of lack of homogeneity of tellurium has ever appeared to the author.

An Improved Method for the Qualitative Analysis of the Tin Group, including the Detection of some of the Rarer Elements: Arthur A. Noyes and Wm. C. Bray.

ORGANIC CHEMISTRY

A. S. Wheeler, Chairman

The Nitration of N-Substituted Anilines: J. Bishop Tingle and F. C. Blanck.

A continuation of the work already reported (*Amer. Chem. Jour.*, **36**, 305). The additional results obtained appear to warrant the statement of the following provisional rule: *In the nitration of N-substituted aniline derivatives, by means of a mixture of nitric and some other acid, the position of the first entering nitro group depends on two influences, viz., the nature of this N-substituting group and the strength of the acid, other than nitric, which is present, and these two factors may be so selected as to neutralize or reinforce each other.*

The Nitration of Benzene: J. Bishop Tingle and F. C. Blanck.

An investigation of the formation of dinitrobenzene in the presence of sulphuric acid and also of non-acidic or feebly acidic dehydrating agents. The results indicate that the formation of the dinitro derivative is preceded by that of mononitrobenzene. The use of sulphuric acid appears to give a larger yield of crude nitration products containing a lower percentage of *meta* compound and about the same percentage of mixed isomers soluble in alcohol. As nitric acid is a stronger acid than sulphuric, the result accords with the 'rule' deduced from the nitration experiments with N-substituted anilines and indicates that the rule is of general application.

Acyl Derivatives of Ortho- and Paraminophenols: J. Bishop Tingle and L. F. Williams.

An easy method is described for the preparation of ortho- and paraminophenol by which good yields are obtained. Many new acyl derivatives of these compounds are described. The results of the work may be summarized by saying that, of the thirty derivatives of this type now known, thirteen have been obtained for the first time by the authors, three have been prepared by newer and simpler methods, the melting point of one other has been corrected and the existence of two of the remainder has been shown to be extremely doubtful.

Condensation of 1, 3-Diketones with Secondary Amines: J. Bishop Tingle and L. F. Williams.

A number of condensation compounds of camphoroxalic acid and secondary amines have been prepared. Their existence tells strongly in favor of the enolic formula for camphoroxalic acid. The amines employed were acetylphenylhydrazine, dibenzylamine, diamylamine and diisoamylamine; similar products from dimethylamine and diethylamine have been previously obtained by the senior author, and, as a class, the substances are believed to be new. Condensation compounds, belonging to various types, of the above acid with the following primary amines have also been obtained: ethylamine, orthoaminophenol and paranitraniline. Camphoroxalic acid and triethylamine yield a salt.

The Relative Value of Calcium, Sodium, Sodamide and Sodium Ethylate in Promoting the Claisen Reaction: J. BISHOP TINGLE and ERNEST E. GORSLINE.

The experiments were carried out with camphor and various esters employing the condensing agents mentioned above. The effects of temperature, solvent and of certain other factors were studied. The best agent is sodium wire; calcium and sodamide are about equal in condensing power, but are decidedly inferior to sodium; sodium ethylate is the least active condensing material. The effect of the solvent is very marked, it is independent of the temperature and the question is raised as to the possibility of its playing a definite chemical part in the condensation, similar, perhaps, to its rôle in the formation of the Grignard reagent.

Preparation of Aniline Derivatives of Succinic and Phthalic Acids: J. BISHOP TINGLE and MARSHALL P. CRAM.

The current methods for the preparation of succinanil and of succinanilic acid have been somewhat modified. Succinanilide has been prepared by a new and simple method. A modified process for the preparation of phthalanil is described and also some experiments regarding the preparation and relative stability of phthalanilic acid and of phthalanilide.

Hydrazones of Aromatic Hydroxyketones; Alkali-Insoluble Phenols: HENRY A. TORREY and H. B. KIPPER.

It was found that many aromatic hydroxyketones, such as, pæonol, resodiacetophenone, dibenzohydroquinol and dibenzoresorcinol gave stable phenylhydrazones. These hydrazones, though from their method of preparation they would appear to have one or more free hydroxyl groups, are, nevertheless, insoluble in aqueous alkalies. It is possible that the insolubility of these compounds may be due to their having a quinoid structure, and that no hydroxyl group is actually present.

Quinazolinecarboxylic Acids: M. T. BOGERT, J. D. WIGGIN and J. E. SINCLAIR.

The authors converted 3-amino-1,4-xylene and 4-amino-1,3-xylene, into their acetyl derivatives, oxidized the latter to the corresponding phthalic acids, changed these aminophthalic acids into their acetanthranils, and prepared quinazolinecarboxylic acids from the latter by condensation with various primary amines.

Isomeric Oxygen and Nitrogen Ethers in the Quinazoline Group: M. T. BOGERT and H. A. SEIL.

The authors prepared various quinazoline ethers of the type -OR and -NR by alkylation of the hydroxyquinazolines and by other methods. They find that methyl iodide invariably gives the -NR compound, while ethyl iodide generally yields the oxygen ether.

4-Aminophthalic Acid and Some of its Derivatives: M. T. BOGERT and R. R. RENSHAW.

A description of the methods of preparation and properties of 4-aminophthalic acid and the following derivatives: the hydrochloride, a number of metallic salts, the anhydride, imide, monomethylaminoimide, the 4-monoamide of trimellitic acid, the dimethyl succinimido- and dimethyl phthalimidophthalate, and the 3,4-dimethyl ester of diphthalylurea.

Synthesis of 7-Nitroquinazolines from 4-Nitroorthotoluidine: M. T. BOGERT and W. KLABER.

4-nitroacetanthranil was condensed with various primary amines, both aromatic and aliphatic, thus producing the 7-nitro-2-methyl-4-ketodihydroquinazoline derivatives. The amines employed included amino-esters, nitriles and diamines.

The Synthesis of Naphthotetrazines from p-Diaminoterephthalic Acid and Related Compounds: M. T. Bogert and J. M. Nelson.

The diphenyluraminodiacetyl derivatives of *p*-diaminoterephthalic diethyl ester, and the corresponding diacetdianthranil were prepared. These were condensed with ammonia, and some of the aromatic and aliphatic primary amines, and the corresponding naphthotetrazines obtained.

Diphenylbrommethylamine: F. J. Moore.

The Basic Properties of Carbon: J. F. Norris.

The fact was brought out that certain derivatives of methyl alcohol show the properties of weak bases. Triphenylcarbinol is converted by concentrated aqueous solutions of hydrochloric, hydrobromic, and hydriodic acids into the corresponding salts. Tertiary butyl alcohol also shows this property. Tritolycarbinol is changed into tritolymethyl chloride by dilute hydrochloric acid, and readily forms a nitrate with nitric acid. The ethers of these carbinols are converted into the chlorides of the substituted methyl radicals by aqueous hydrochloric acid, and the ethers can be formed by the action of a few drops of dilute hydrochloric acid on an alcoholic solution of the carbinols.

INDUSTRIAL CHEMISTRY

A. D. Little, Chairman

When is Time of More Value than Refinement of Method? Mrs. Ellen H. Richards.

The purpose of the investigation was to ascertain the practicability of shortening and intensifying quantitative methods of investigation in sanitary and industrial chemistry so that they could be intelligently used by high school pupils. The results were promising enough to be extended by other laboratory workers, and the purpose of the paper was to urge more attention to ways of interesting the public in order that research may be more fully supported by non-scientific business men and state and city officials.

A Rapid Method for the Determination of Calcium in Water and its Significance in Connection with the Analysis of Water for Boiler Purposes: F. E. Hale.

Air Elutriation of Fine Powders: Allerton S. Cushman.

In order to study the influences of fineness of the particles on the rate of decomposition of rock powders when acted on by water, it has been necessary to devise an air separator for use in the laboratory. By means of a simple apparatus in which both blast and vacuum are employed, it has been possible to easily separate powders that have passed the finest meshed sieves obtainable into four or five graded sizes. A 200-mesh rock powder invariably contains a certain proportion of particles that may be called ultimately fine, having reached the mechanical limits of possible subdivision. If these smallest particles can be separated interesting investigations can be made on the influence of the maximum surface area for unit weight, when the powders are acted on by water.

The Relation between the Ultimate Composition and the Physical Properties of Portland Cement: Richard K. Meade.

The Available Hydrogen of Coal: S. W. Parr.

The fundamental proposition is based on the idea that the original substance from which coal has resulted was made up of substantially the same sort of material and the 'products of decomposition represent a progression which at any given stage in any case bear a constant likeness of composition at the same stage in another case.' By selecting, therefore, a proper unit of

comparison a curve may be developed which shall show at any point of reference the amount of available hydrogen present. Tabulations of results from 180 coals widely distributed throughout the United States show an average as to accuracy approximately one third better than the results as derived from ultimate analysis.

The Testing of Copper and its By-products in American Refineries: GEORGE L. HEATH.

A proper analytical control of refining is attained by the determination of the quality of all supplies and fluxes, and by mechanical, electrical and chemical tests of the metal itself. The growing severity of commercial requirements in regard to the purity and electrical conductivity of a metal, whose properties are sensibly affected by less than 0.002 per cent. of some foreign elements, makes the knowledge and control of its impurities a problem of the highest importance for the present and future, to both producer and consumer.

A condensed account was given of the latest methods of analysis, and assaying in use at large smelting and custom laboratories, giving preference to those considered most accurate.

A determination may be required of one, or all, of the following elements; copper, gold, silver, oxygen, sulphur, selenium, tellurium, arsenic, antimony, tin, lead, iron, zinc, cobalt, nickel and manganese, and appropriate methods of analysis are indicated, in the original paper, for each natural group of foreign constituents. A short discussion is also given of the technical determination of the electrical resistance of copper, mentioning some causes of lack of agreement in commercial tests.

The Osage Orange: a Dye Wood: A. S. WHEELER and STROUD JORDAN.

The bright yellow coloring matter is extracted with alcohol, giving a beautiful green-red fluorescent solution. Textile fabrics are readily dyed. The dye is not a good indicator. Its constitution is under investigation.

The Determination of Arsenic and other Solid Constituents of Smelter Smoke, with a Study of the Effects of High Stacks and Large Condensing Flues: WM. D. HARKINS.

The amounts of materials of industrial value given out in the smoke are often enormous. The analysis of the smoke of one smelter shows an approximate daily output in the smoke of fifty-five thousand pounds of arsenic trioxide, three to four million pounds of sulphur dioxide, three hundred thousand pounds of sulphur trioxide, six thousand pounds of zinc, five thousand of copper, six thousand of lead, five thousand of antimony, etc. High stacks throw the smoke to a greater distance from the smelter than low stacks. Captain Taylor's pilot tube is the best instrument for velocity determinations.

Gases vs. Solids: an Investigation of the Injurious Ingredients of Smelter Smoke: W. C. EBAUGH.

The results of experiments upon alfalfa and sugar beet plants with (*a*) gaseous sulphur dioxide, (*b*) aqueous solutions of sulphur dioxide, and (*c*) 'flue dust' or fume in various forms, show that heretofore the amount of injury done by sulphur dioxide has been unduly emphasized, and that that due to the solid emanations of the smelters has been ignored. The effects of the investigations will be to modify the means adopted by smelting plants to eliminate the dangerous substances from their smoke.

Experiments on the Manufacture of Chlorates and Hypochlorites with a View to High Current Efficiency: A. G. BETTS and R. H. SHERRY.

A series of experiments was made using

different cathodes and also with the addition of various substances to the solutions. It was found that magnesium used as cathode gave a high current efficiency. Comparative results gave the current efficiency in a solution of potassium chloride to which sodium chromate had been added as 69.3 per cent., and in a potassium chloride solution with a magnesium cathode as 65 per cent. On a continuous run the efficiency of this cathode in making chlorate was 90 per cent. the first hour and 60 per cent. from the fourth through the eighth hour. In making hypochlorite with a 12.5 per cent. salt solution the efficiency was 96 per cent. for the first hour and 75 per cent. for the ninth hour. The loss of magnesium was very small. It was found that from one third to one half the salt could be converted and a current yield of from 60 per cent. to 70 per cent. could be obtained. In addition to this advantage, the power cost is low. The hypochlorite solution is quite clear and ready for use after dilution.

A Plea for the Systematic Study of American Gas Coals: H. B. Harrop.

Standard fields like the 'Pittsburg' are now working down to poor grades, while many areas now believed to be unsuitable may yet be proved satisfactory. Knowledge of location, extent and character of various coal deposits capable of supplying gas works and by-product oven plants is very meager both among gas engineers and commercial chemical engineers. Qualities of coal required for gas works and ovens discussed: gas yield, character of gas, impurities, quality of coke, tendency of ash to 'clinker,' and suitable carbonizing treatment. The author discusses, in the light of his own experiments, the merits and failings of the crucible volatile matter test and the practicability of a standard apparatus for determining the best carbonizing temperature, gas yield and character of gas. A committee is recommended to cooperate with the Coal Mapping Subcommittee of the American Gas Institute.

Viscosity and Lubrication: Chas. F. Mabery and J. H. Mathews.

This paper presented results on the chemical composition, viscosity and durability tests of lubricating oils, manufactured from different petroleums, and the composition and viscosity of the principal constituents of commercial lubricating oils. The hydrocarbons examined and separated from the crude petroleum from different fields, as well as from the lubricating oils themselves, were of the series of hydrocarbons, C_nH_{2n+2}, C_nH_{2n}, C_nH_{2n-2}, C_nH_{2n-4}. The viscosity of these series varies regularly from the series C_nH_{2n+2}, which is very low, to the series C_nH_{2n-4}, which has a very high viscosity corresponding to the high viscosity of lubricating oils made from the heavy petroleum that is composed largely of the series, C_nH_{2n}, C_nH_{2n-2}, C_nH_{2n-4}. The durability tests corresponded to the variation in viscosity. Viscosity was determined in the apparatus of Ostwald, and calculated from his formula

$$n = n_0(td/t_0d_0).$$

Viscosity of these products was also determined by the Saybolt universal viscosimeter. The durability tests were made on a bearing under 500 revolutions carrying a load of 500 pounds, with a regular addition of the oil at the rate of six drops per minute, during the first two hours. During the tests readings of temperature were taken at intervals of five minutes and the friction was also determined from readings of weights on a balance taken at the same intervals. The coefficient of friction was calculated from the formula $F = WL/R$ where $W =$ dif. in wt. lbs.; $L =$ length of lever; $R =$ radius of axle. A comparison of various lubricating oils showed that

viscosity alone can not be relied on as an accurate means for determining their commercial value in lubrication. This work is being extended, including the question as to the comparative value of straight hydrocarbon oils and compounded oils and any harmful effects of the latter due to corrosion.

Suspensions in Dilute Alkaline Solutions: W. R. WHITNEY and ALONZO STRAW.

The Annealing of Sterling Silver: W. H. WALKER.

The sterling silver of commerce is an alloy of 92.5 per cent. silver and 7.5 per cent. copper. The frequent annealing incident to the manufacture of silver-ware produces, when the article is polished, a black reflex or sheen called by the workmen 'fire surface.' This can be removed only by dissolving in nitric acid that portion of the ware affected. A study of this matter shows that, notwithstanding the literature on the subject to the contrary, the difficulty is caused by the formation of copper oxide in the alloy, and that it may be prevented by annealing under such conditions as will practically eliminate oxygen. A method based on the above observations is now in practical use in a number of establishments.

Fullers' Earth and its Application to the Bleaching of Oils: C. L. PARSONS.

A paper on the American occurrence, the properties and absorptive qualities of fullers' earth.

The Modern Canning Industry: Mr. MORRIS.

Denatured Alcohol and the New Law: C. E. MUNROE.

Rosin Size of High Free-Rosin Content: EDWARD F. MOODY.

Discussed the rosin sizing of paper, with particular reference to mill-made sizes, composed of completely saponified rosin, as compared with the more recent developments in high free-rosin sizes. The sizing effects of the former were shown to be due to the precipitated aluminum resinate, which, being somewhat soluble in water, is not a perfect water-proofing agent in paper; whereas, in the latter case, the insoluble rosin itself is the sizing agent, producing the desired results more economically. Also the causes of froth, imperfect sizing and other matters of interest to the paper industry were discussed.

Agricultural and Sanitary Chemistry—L. L. Van Slyke, chairman.

Food Adulterations: C. B. COCHRAN. (By title.)

India Beeswax: J. F. GEISLER.

The Efficiency of Certain Phosphates as Influenced by Liming and by the Variety of the Plant: H. J. WHEELER and G. E. ADAMS.

Field experiments with nine different phosphates have been in progress at the Rhode Island Agricultural Experiment Station since 1894.

In one series lime has been applied in small quantities and in the other it has been omitted. Many different varieties of plants have been employed. The results show marked benefit from liming in connection with superphosphates, and in a less degree with floats, bone meal, and basic slag meal. The soil is naturally practically devoid of carbonate of lime and when moistened, quickly and intensely reddens blue litmus paper. No doubt liming in excess would have the opposite effect on superphosphates. The cabbage and some other crops were practically a total failure where floats were used, yet certain other varieties of plants made much better use of them.

The most remarkable feature was the wonderful effect of liming in increasing the efficiency of the roasted Redondite

(iron and aluminum phosphate). This material contains a total of 45 to 50 per cent. phosphorus pentoxid, of which 38 to 40 per cent. is 'reverted'; also 2.5 to 3.5 per cent. ferric oxid and 45 to 50 per cent. aluminum oxid. Liming was of no benefit and acted injuriously in connection with the finely ground unroasted material. The efficiency of the phosphates is influenced by the soil, the other manures, and by the variety of plant in a most marked degree, hence the danger of drawing conclusions from insufficient data is great.

The Functions and Agricultural Value of Certain Sodium Salts: H. J. Wheeler, B. L. Hartwell and F. R. Pember.

The investigation of this question has been in progress at the Rhode Island Agricultural Experiment Station since 1894.

Plants have been grown in the field during twelve years by the use of sodium carbonate and sodium chloride, by the corresponding potassium salts and by various mixtures of the sodium and potassium salts. Evidence was afforded of a liberation of potassium from the soil by the sodium salts. When the supply of potassium was limited sodium salts greatly increased the yields of the mangel wurzel, turnip, radish and certain other root crops; at the same time the percentage of phosphorus in the dry matter was usually increased. This increase was greater in the case of the carbonates than with the chlorids, however it seemed to be an incidental accompaniment of, rather than the cause of, the increased yield. Sodium did not appear to have been of special benefit because of its serving as a better carrier of nitrogen to the plant than potassium, neither was the benefit explainable by virtue of liberating lime or magnesia nor on account of changes in the relation of the two, removed by the plant.

Sand culture and water culture were both resorted to in order to eliminate factors arising in the field. The results thus far secured by water culture show benefit from sodium in the presence of small supplies of potassium, which is not obtained in the same degree when a like osmotic pressure is provided by the employment of salts of calcium. Sodium seems to enable a small supply of potassium to produce a larger crop by virtue of performing some part of the functions which potassium may perform if present in sufficient quantities. Sodium used in connection with potassium sometimes prevents plants from taking so great an excess of potassium from the soil as they would otherwise remove.

The Action of Acids on Casein when no Solution takes Place: L. L. Van Slyke and D. D. Van Slyke.

When casein is suspended in a solution of acid, the casein takes acid from the solution, the casein remaining solid under proper conditions of dilution of acid, temperature, etc. The amount of acid thus taken up by casein varies with the concentration of the acid, the temperature, the time of contact and the kind of acid. The phenomena do not indicate simple chemical combination of acid and casein, but correspond closely to the conditions described by van Bemmeln as applying to what he calls absorption compounds.

The Accuracy of Phenolphthalein as an Indicator in Determining the Acidity of Casein: L. L. Van Slyke and D. D. Van Slyke.

In determining the acidity of casein by titration with alkali, different indicators give different results. With phenolphthalein higher results are given than with litmus or methyl orange. The results with phenolphthalein have been chosen arbitrarily as being most accurate. Measurement of the conductivity of the solution

was used. When a given amount of alkali solution is neutralized by addition of casein, the solution decreases in conductivity until the neutral point is reached, after which further additions of casein do not change the conductivity. The results thus obtained agree quite closely with those given by phenolphthalein.

The Sanitary Analysis of Water: L. P. KINNICUTT.

The Organic Components of the Soil in their Relation to some Properties of Roots: OSWALD SCHREINER and HOWARD S. REED.

The authors pointed out the toxic properties of soil extracts from unproductive soils and the effect of absorbing agents, organic substances and simple treatments, such as dilution with water, boiling, etc., in improving the conditions for plant growth. The oxidizing power of plant roots in connection with these toxic conditions, and the effect of fertilizers on these oxidizing properties were emphasized, as was also the production of toxic conditions by previous root growth.

Comparative Intensities of Colors used in Confectionery: EDWARD GUDEMAN.

Method of obtaining strength of colors without comparison with standard color, based on height of column through which diffused light will pass. Description of apparatus. Details and results withheld on account of other investigations on colors now being made.

The Changes in the Fat of Bread during Baking, and Methods for its Determination: J. S. CHAMBERLAIN.

The Unification of Reducing Sugar Methods: PERCY H. WALKER.

The Ripening of Strawberries, Raspberries, Blackberries, Gooseberries and Currants: W. D. BIGELOW and H. C. GORE.

The Preparation and Composition of Vinegar from Kieffer Pears: H. C. GORE.

The Preparation of Unfermented Apple Juice: H. C. GORE.

Absorption by Soils: F. K. CAMERON and H. E. PATTEN.

Various types of distribution curves and velocity equations were considered, and illustrated by examples from the literature and the authors' own experiments with dyestuffs, fertilizer salts and liquid manures. The causes for variations which soils present, from the ideal types, were pointed out, and the magnitude of absorption effects was shown to be much greater than is usually supposed.

A Comparison of Methods for the Determination of the Alkalinity of Ash: HERMANN C. LYTHGOE.

Varying results on alkalinity of ash are reported by different chemists owing to the use of different indicators. The results reported in the following table were obtained on one sample each of vinegar, lime juice and raspberry syrup. The difference in the results is due to the presence of phosphates.

ALKALINITY OF ASH. C.C. OF N/10 ACID REQUIRED TO NEUTRALIZE THE ASH OF 100 GRAMS OF SAMPLE.

Character of Sample	Indicator			
	Phenol-phthalein	Methyl Orange	Cochineal	Litmus
Vinegar	33.1	40.9	37.9	24.9
Lime juice	15.8	18.8	17.5	12.2
Raspberry syrup.....	15.5	20.3	17.1	11.0

The Possible Use of Corn Oil as an Adulterant of Lard and its Detection: WM. MCPHERSON and WARREN A. RUTH. (By title.)

The Influence of Climate on the Composition of Wheat: J. A. LECLERC.

The Work of the Association of Official Agricultural Chemists on the Analysis of Tanning Materials: F. P. Veitch.

Soil Acidity in its Relation to Lack of Available Phosphates: A. R. Whitson and C. W. Stoddart.

Experience has shown that a direct determination of the amount of essential elements present in a soil does not show its fertility, since it does not consider the degree of availability. It is unquestionably true, however, that the processes by which these elements become available are chemical, and depend upon the conditions existing in the soil. A determination of the conditions which influence the rate at which the elements become available and which affect the accumulation of the available material would enable us to diagnose the needs of the soil more quickly and surely than by direct field and pot experiments. Investigations of the fertilizer requirements of soils during the past two or three years have shown that whenever a soil is acid it needs phosphates.

Careful tests were made on nineteen soils, thirteen of them acid. All acid soils showed by field or plant-house tests the need of a phosphate fertilizer. Three of the soils, not acid, showed the need of phosphates, although rather slight in one case. The soils tested were mostly clays from as many different localities in Wisconsin as possible.

Although there is phosphoric acid present in these soils in sufficient quantity for many crops it is unavailable, and hence the soils need phosphate fertilizers. The soil acids probably act upon the readily available phosphates, such as the calcium phosphates, at a more rapid rate than the normal, neutral or alkaline soil moisture, and when once in solution these phosphates are readily washed out by heavy rains, or are fixed by iron and aluminium hydroxides—that is, are precipitated and rendered unavailable as insoluble iron and aluminium phosphates. When there is sufficient lime in the soil to maintain the phosphoric acid in the form of calcium phosphates, the plant is able to obtain enough phosphorus for its use, since calcium phosphate is soluble enough to supply the needs of a growing crop.

A Quick Method for the Determination of Moisture in Grain: E. Brown and J. W. T. Duvel.

By the use of the method and the apparatus outlined in this paper, the moisture content of any sample of grain or similar material, can be determined in from twenty to thirty minutes. The method consists primarily in heating the weighed sample of grain in about 100 c.c. of hydrocarbon oil, the moisture expelled being afterwards condensed and measured in a graduated flask reading to tenths per cent. A special apparatus is required for this method of making moisture determinations.

In the afternoon a number of the chemists were given a luncheon at the works of the Schultz Mineral Water Company, after which there was a choice of excursions to the Gas Works, the Pacific Borax Works and the New Jersey Zinc Works at Newark. The same evening there was a subscription dinner at the Waldorf Hotel.

On Saturday morning the annual meeting of the American Chemical Society was held. The secretary reported that the membership was now 3,079, a net gain of 160 over last year. There are, besides, 187 members who have been elected, but who have not yet qualified. Of the latter, 150 had applied during the last two months. New local sections have been established in Minnesota, Indiana, Louisiana and at the University of Illinois.

The report of the treasurer showed that

the finances of the society are in a satisfactory condition.

The report of the librarian was also read.

The editor reported that during 1906, 217 papers had been submitted for publication, of which 160 had been accepted without change, 25 after revision and 32 were not suitable for the *Chemical Journal*. Of these last, many were considered as better adapted for journals of a more general nature, and were rejected by the committee on publications solely for this reason. The editor also gave an account of the progress which had been made on the new journal, *Chemical Abstracts*. It is planned to make it fully as complete as the *Zentralblatt*, and two numbers will be issued each month. He urged that every member of the society try to encourage other chemists to join. To meet the cost of the new publication the dues have been raised to eight dollars, but it will not be possible to continue the publication if any considerable number of the members drop out on this account. In this connection he stated that the gratifying increase in membership during the last few months of the year was largely due to the new journal.

With a view to increasing the usefulness of *Chemical Abstracts* the council appointed a committee to consider the relationship of the society to other chemical organizations and to other chemical publications. It was also decided to add to the council two new members, both of whom were to be technical chemists.

The officers of the society for 1907 are:

President—M. T. Bogert.
Vice-Presidents—The presidents of the local sections.
Secretary and Editor—Wm. A. Noyes.
Treasurer—A. P. Hallock.
Librarian—E. G. Love.

J. H. Long, chairman of the committee on the quality of reagents, reported that the committee was in process of reorganization.

W. F. Hillebrand, chairman of the committee on uniformity of technical analysis, reported that there had been organized subcommittees on zinc ores, rosin and shellac and phosphate rock.

L. P. Kinnicutt, chairman, stated that the committee on water analysis had been reviewing and testing various methods of analysis.

J. H. Long, chairman of the committee on untaxed alcohol, requested that the committee be disbanded, as a satisfactory law had been passed by Congress.

The meeting of the Chemical Society was followed by a meeting of Section C, at which the following report and addresses were given:

G. C. Stone and W. George Waring: Report of the committee on the analysis of zinc ores. Gave the tabulated results of three series of analyses of zinc ores and said that a fourth sample would soon be sent out.

Cellulose: A. S. WHEELER.

Agricultural Chemistry in Relation to Research: L. L. VAN SLYKE.

At noon the meeting adjourned to the College of the City of New York, where two lectures were given:

The Electrical Industries at Niagara Falls: C. F. CHANDLER.

The Geology of Niagara Falls: JOHN M. CLARK.

After the addresses the chemists were entertained at luncheon in the gymnasium of the college. After this visits were paid to a brewery in the neighborhood, the Interborough Power Station and the American Museum of Natural History.

In the evening the retiring president, W. F. Hillebrand, delivered an address on 'The Present and Future of the American

Chemical Society.' This has been published in SCIENCE and in the *Journal* of the society. After the address the visiting members were given a complimentary smoker by the members of the club.

On Monday other meetings of sections were held.

PHYSICAL CHEMISTRY

Alexander Smith, Chairman

The Electrolytic Purification of Cerium: J. P. MAGNUSSON.

The Conductivity and Ionization of Salts in Aqueous Solution at High Temperatures: A. A. NOYES, W. D. COOLIDGE, A. C. MELCHER, H. C. COOPER and G. W. EASTMAN.

The Hydrolysis of Salts and the Ionization of Water from 0° to 306°: A. A. NOYES, Y. KATO, R. B. SOSMAN and C. W. KANOLT.

Photochemistry and the Phase Rule: WILDER D. BANCROFT.

Thermochemistry: JOSEPH W. RICHARDS.

Discussed the mechanism of endothermic reactions, taking as types of three common reactions the reduction of zinc oxide by carbon, the production of water gas by steam acting on carbon, and the reduction of iron oxides by carbon monoxide in the blast furnace. The analogy of these reactions to simple physical changes absorbing heat, was particularly dwelt upon.

The Final Disintegration Products of Uranium: B. B. BOLTWOOD.

The conclusion is reached that in unaltered, primary minerals from the same locality the amount of lead is proportional to the amount of uranium, and that in unaltered, primary minerals from different localities the amount of lead relative to uranium is greatest in minerals from the locality which is geologically the oldest. Hence lead seems to be the final disintegration product of uranium. The amounts of helium found in minerals containing both uranium and thorium are of about the order, and are not in excess of the quantities, to be expected from the assumption that helium is produced by the disintegration of uranium and its products only. From the composition of radioactive minerals it appears highly improbable that either lead or helium is a disintegration product of thorium.

Solution in a Dissolved Solid: CHARLES L. PARSONS.

A study of solutions of iodine in potassium iodide, of lead oxide in solution of lead acetate, of camphor in aqueous acetic acid, of iodine in aqueous acetic acid, etc. It is shown that some solids in solution form a mixed liquid which acts perfectly analogous toward some solutes, to the well-known cases of ternary mixtures where a solid or a liquid is dissolved in two mixed liquids. It was, furthermore, pointed out that many of the physical properties, generally accepted as abnormal, of ternary mixtures are in reality perfectly normal and that in many such cases polymerization is not at all necessary to qualitatively explain the supposed variation from the gas laws.

The Electromotive Force of the Oxyhydrogen Cell: G. N. LEWIS.

Measurements of free energy (the maximum work obtainable from a chemical process) not only are of great importance technically, but they also permit the chemist to predict in what direction and how far chemical reactions will progress. The free energy of many important oxidation processes can be calculated if the potential of the oxygen electrode is known, or the E.M.F. of the oxyhydrogen cell. This was determined in three ways: (1) from the decomposition pressure of silver oxide between 300° and 445°, (2) from measure-

ments of the equilibrium in the Deacon process between 350° and 420°, and (3) from the decomposition pressure of mercuric oxide. These methods give concordant results which show that the E.M.F. of the oxyhydrogen cell is about 1.224 volts, a value which is higher by one tenth of a volt than the one hitherto accepted.

Calculation of Some Chemical Equilibria by the Nernst Formulas: K. G. FALK.

The equilibria for the reactions

$$2SO_2 + O_2 = 2SO_3, \quad H_2 + Cl_2 = 2HCl,$$
$$H_2 + Br_2 = 2HBr$$

are calculated for different temperatures by means of the formulas developed by Nernst, and which formed the subject of the Silliman lectures (delivered by Nernst) at Yale University in 1906. The calculated values are compared with those found experimentally.

Cadmium Sulphate and Mercurous Sulphate: G. A. HULETT.

The Quantitative Determination of Small Quantities of Arsenic by the Method of Marsh-Liebig as affected by Supertension and Potential Differences: WM. D. HARKINS.

The injurious action of iron and other metals in hindering the reduction of arsenic in the Marsh apparatus, can be prevented by using a temperature of 100° or by the addition of salts of tin, cadmium, lead or bismuth, using the proper conditions. The factors aiding in the reduction when a foreign metal is present or added are: (1) (most important) high superpotential; (2) distance from zinc in the scale of potentials; (3) degree of solubility of the salts formed. Two lengths of hard glass tube should be heated in two fire-brick furnaces to give complete decomposition of the arsine. The method is quantitative.

The Vapor Pressure of Aqueous Nitrate Solutions by the Air-bubbling Method: A. T. LINCOLN. (By title.)

Melting-point Determinations at Low Temperatures: LEO F. GUTTMANN.

A constantan-copper couple connected in series with a sensitive D'Arsonval galvanometer is used, and standardized by determining the known melting points of ice, chloroform, paste of solid carbon dioxide and alcohol, ether and the temperature of liquid air. From the data thus obtained a calibration curve is drawn up. To determine the melting point of a substance, the couple is immersed in the liquid contained in a glass tube, and the liquid frozen. By allowing the substance to warm up slowly, and watching the galvanometer deflections the melting point is ascertained. The melting points determined were those of some of the alkyl alcohols, esters, and iodides, the paraffins, acetaldehyde, ethyl methyl ketone, acetone, ethyl bromide and chloride, toluene, ethylbenzene and the xylenes.

The System Sodium Chloride, Sodium Sulphate, Calcium Sulphate and Water: F. K. CAMERON, J. M. BELL and W. O. ROBINSON.

The invariant points and boundaries for the system sodium chloride, sodium sulphate, calcium sulphate, and water were determined at 25° and the solid diagram constructed. It was shown that fields existed for solutions in contact with the following solid phases: NaCl, $Na_2SO_4 \cdot 10H_2O$, $2Na_2SO_4 \cdot 3CaSO_4$ (glauberite) and $CaSO_4 \cdot H_2O$. No anhydrite field exists.

The Colors of Colloidal Silver: WILDER D. BANCROFT. (By title.)

Studies in Catalysis; Amidine Formation: JULIUS STIEGLITZ.

The formation of amidines according to: $RC(:NH)OR' + NH_3 = RC(:NH)NH_2$

+ HOR', is accelerated by the addition of an acid (HCl) or of an ammonium salt (NH_4Cl), simply because the reaction substance is not the whole imino ester but only its positive ions. A constant is obtained on the basis of the isothermal equation: $dx/dt = K \times C_{\text{pos. ester ions}} \times C_{NH_3}$, the velocity being always proportionate to the concentration of the positive ester ions, although they form only a very small but rigorously calculable part of the ester used. The results are in entire accord with the author's theory of the catalysis of esters, cane-sugar, etc., under the influence of acids.

Freezing Points of Mixtures of Sulphur and Iodine: Alexander Smith and C. M. Carson. (By title.)

This report has been transmitted through Professor Charles L. Parsons, Secretary of Section C.

C. E. Waters,
Press Secretary.

(To be continued)

THE ASSOCIATION OF AMERICAN GEOGRAPHERS

The third annual meeting of this association was held December 31, 1906, and January 1, 1907, at the building of the American Geographical Society, in New York City. The president, Mr. Cyrus C. Adams, presided, and delivered the president's address upon the subject, 'Some Phases of Future Geographical Work in America.'

Professor I. C. Russell, member and councilor of the association, died during the year, and a memorial was read by Professor W. M. Davis. The Monday evening session was devoted to the following addresses: Mrs. Leonidas Hubbard, Jr., 'The Rapids of Labrador Rivers'; Dr. F. A. Cook, 'The Ascent of Mount McKinley'; Mr. Alfred H. Brooks, 'A Meeting with Captain Amundsen at Nome.'

In the general program the following papers were read by their authors:

William Churchill, 'Insularism, and the Nesiote Type'; A. L. Rotch, 'The Circulation and Temperature of the Atmosphere at Great Heights above the Tropical Atlantic'; Charles C. Adams, 'The Evolution of the Isle Royal Biotic Environment'; G. E. Condra, 'The Opening of the Indian Territory'; I. Bowman, 'The Deserts of Peru and Chili in South American History'; E. N. Transeau, 'The Need of Evaporation Data in Plant Geography'; William Libbey, 'Problems of the Panama Canal'; W J McGee, 'The Prospective Conquest of the Mississippi River'; Angelo Heilprin, 'Guiana and Venezuela as a Field for Geographical Exploration, with some Observations on a Recent Visit to the Essequibo Wilderness'; G. W. Littlehales, 'The Nature and Purpose of the Chart Publications of the Navy Department, and their Geographical Extent'; E. O. Hovey, 'The Isthmus of Tehuantepec'; Alfred H. Brooks, 'Railway Routes in Alaska'; H. L. Bridgeman, 'The International Polar Congress at Brussels'; E. Huntington, 'Influence of Change of Climate upon History'; R. DeC. Ward, 'The Meteorology of the North and South Polar Areas'; W. M. Davis, 'Place of Coastal Plains in Systematic Physiography'; W J McGee, 'The American Deserts and their Reclamation'; W. M. Davis, 'Geography as defined by Hettner'; F. P. Gulliver, 'The Orientation of Maps'; A. P. Brigham, 'Geography for College Entrance'; Collier Cobb, 'Hatteras Island and its Shifting Sands'; D. W. Johnson, 'The Texture of Topography'; W. M. Davis, 'The Eastern Slope of Mexico'; H. E. Merwin, 'Land Forms as Plant Controls'; Cleveland Abbe, 'A Study of Airy's Projection by Balance of Errors'; A. W. Grabau, 'Classification of Marine Life Districts.'

The annual dinner was held on Tuesday

evening at the Hotel Colonial. The next annual meeting will be held in Chicago.

Professor Angelo Heilprin is president for the year 1907. The complete list of officers has already been published in SCIENCE.

ALBERT PERRY BRIGHAM,
Secretary

SCIENTIFIC BOOKS

Petrogenesis. By Dr. C. DOELTER. Braunschweig, Friedr. Vieweg and Son. 1906. Pp. xii + 261; 1 plate and 5 figures. 8vo. Paper. 7 M.

This is Volume XIII. of a series of monographs on natural history and mathematics entitled 'Die Wissenschaft.' In it Professor Doelter, of the University of Gratz, presents an outline of the knowledge and theories concerning rocks of all kinds. The comprehensive treatise is put in the form of fourteen chapters, the first ten of which deal with volcanic rocks, the last four with contact metamorphism, the formation of the crystalline schists, sediments, and chemical precipitates. One hundred and fifty pages are devoted to the problems of igneous rocks, fifty-two to those of the crystalline schists.

The method of treatment is to present the views of various geologists or petrographers on different topics, sometimes with comments and criticisms, sometimes without. The citations are many, but from the nature of the task, perhaps, they are not always complete as to number or entirely satisfactory as to substance in some instances. However, there is a great fund of information for the student and an abundance of valuable bibliographic references. The scope of the work is so large that it is not possible to review the book with the thoroughness it deserves without a very considerable expenditure of time and space. And it may be sufficient to point out the contents of the several chapters in a general manner.

The first is devoted to a consideration of the theories and observations concerning the interior of the earth and the problem of vulcanism. The physics of the interior of the earth is discussed and the observations of Barus and Tammann with reference to melting points and pressure are cited. The possible source of molten magmas, and the causes and mechanics of their eruption are considered, including the rôle of vapors and the temperature of lavas.

The second chapter treats of the forms of volcanic rocks as conditioned by their solidification on the surface of the earth or at some depth below it, and also the influence of vapors upon the crystallization. The discussion of laccolithic forms reveals a curious attitude toward the original definition of the term by Gilbert. In connection with the problem of intrusion the views of Kjerulf and of Michel-Lévy are presented, and those in opposition are credited chiefly to Brögger. Daly's theory is also stated.

The third chapter has to do with the structure (texture) of eruptive rocks. The porphyritic texture is discussed at length with special reference to Fouqué and Michel-Lévy's views and to those of Zirkel. A number of petrographers are cited in connection with the texture of phanerocrystalline rocks, chiefly Brögger, Lane, Teall and Vogt. Spherulitic texture receives considerable attention, the views of Rosenbusch and of others being noted. The question of the relation between age and texture is considered, and the textural and constitutional facies of rock bodies are described.

In the fourth chapter the relation between the mineral composition and the chemical composition of igneous rocks is discussed. The view of Lagorio, Vogt, Morozewicz and Iddings are commented on. The work of Osann in correlating chemical analyses of rocks is reviewed, and the methods of expressing the chemical composition of rocks by means of diagrams are described to some extent, especially those of Brögger and Becke.

The fifth chapter deals with the problem of the differentiation of magmas. Various theories are set forth briefly and commented on. The term is also applied to the crystallization of minerals from molten magmas. Experi-

mental work on the crystallization of rock minerals in the laboratory is reviewed and Doelter's own observations on the precipitation of crystals in molten liquids are noted.

The question of the order of the eruption of different kinds of rocks at given centers of volcanic activity is treated in the sixth chapter. The diverse statements of petrographers as to the order in different regions are noted and the conclusion reached that there is no uniform order which obtains for all regions, but that the succession is highly complex.

The seventh chapter deals with inclusions in igneous rocks, their character and origin. Assimilation and corrosion are discussed in chapter eight. First the changes effected on minerals crystallized from magmas, and then the effects on rocks in contact with molten magmas. The laboratory production of rocks by experimental means is described in chapter nine, especially the researches of Fouqué and Michel-Lévy, and those of Morozewicz.

In the tenth chapter the solidification of volcanic magmas is discussed with reference to the minerals produced under different conditions, and also with respect to the order of their separation. Laws affecting the crystallization of compounds from solutions are reviewed, the question of eutectic mixtures is considered, also the effect of undercooling, the melting point of minerals, and the influence of pressure on separation. The production of tuffs and bombs is also discussed. In the eleventh chapter contact metamorphism is described and its causes and processes discussed.

The crystalline schists are treated in one chapter of fifty-two pages. Various theories as to their origin are reviewed, chiefly those based on specific researches upon special regions or particular occurrences. It will be enough to note the captions under which the subject is treated: Eruptive Gneiss, Gneiss as Altered Granite, Diagenesis, Regional Metamorphism, The Chemical Composition of the Rocks, Alteration by Means of Water, Alteration by Means of High Temperature, Injection Hypothesis, Dynamic Metamorphism, Chemical Reactions in Solids, Plasticity of Rocks, Lateral Pressure, Connection between Metamorphism and Dislocation, Law of the Change of Volume, Mineral Composition of Crystalline Schists, Structure and Texture of Schistose Rocks, Origin of Schistosity, Zones of Metamorphism, Objections to a General Application of Dynamic Metamorphism, Formation of Crystalline Schists by Contact Metamorphism, Comparison of Contact Metamorphism and Dynamic Metamorphism.

The thirteenth chapter treats of sediments, their kinds and modes of formation. The major portion of the chapter is devoted to limestone and the formation of dolomite. The last chapter contains a discussion of the production of chemical precipitates, the deposition of rock salt, gypsum and anhydrite. The works of Bischof, van't Hoff and of Ochsenius are those chiefly cited. J. P. Iddings

The Origin and Structure of the Roxbury Conglomerate. By George Rogers Mansfield. Pp. 180, 7 pls. Cambridge, Mass., November, 1906. Bull. of the Museum of Comparative Zoology at Harvard College, Vol. XLIX. Geol. Series, Vol. VIII., No. 4.

This paper, after a rather lengthy introduction, begins with a forty-five-page chapter on the origin of conglomerates, in which are discussed the various types of conglomerate. The discussion is thorough, and the results, drawn principally from the conclusions and opinions of previous writers in different countries, are tabulated. This digest is of general interest, and is a valuable contribution to the subject.

The remainder of the work deals principally with the three Carboniferous basins of Massachusetts and Rhode Island—the Boston Basin, which includes the Roxbury conglomerate; the Norfolk Basin, and the Narragansett Basin. The text is essentially a critical review of previous publications on these areas, especially of the Boston Basin, which has been studied in great detail by Professor W. O. Crosby. Professor Crosby's work in this region has extended over a period of at least thirty years, and no less than sixteen of his publications are included in the author's bibliography. In view of this fact it is noteworthy that, in the final paragraph of

acknowledgments, Professor Crosby is not mentioned among those personally consulted, although he could have been reached by the author by a half hour's ride. This circumstance is in keeping with the general tone of the text, which leads one to believe that Crosby's work is to be proved faulty. Such a tone is unfortunate, since, with but three or four exceptions, the author is obliged to agree with all of Crosby's conclusions. Of the exceptions noted, one, on page 214, is a resurrection of a controversy between Crosby and Burr, in which the former's contention that certain melaphyr areas were effusive, was disputed by the latter. Crosby's convincing answer to Burr's paper was published in the *American Geologist* (Vol. XXVII., p. 324, 1901), and, so far as known, has met with no reply; but still the present author believes that Burr's conclusions are in many instances correct. Regarding the other exceptions, on pages 206 and 220, the author forms a different *opinion,* but in neither case proves himself correct nor Crosby wrong. In the second case the author states that he has not visited the outcrops which furnish Crosby's evidence. In his concluding chapter he states that, while Crosby attributed to the Roxbury conglomerate a marine origin, 'the evidence, largely negative and unsatisfactory, favors non-marine origin.' This and the conclusion that glaciers may have furnished material to torrents by which it was deposited either upon the land or in lakes are possible, though rather uncertain additions to the previous knowledge of the geology of the Boston Basin. The author has evidently accomplished a great deal of work in the time at his disposal, but it is unfortunate that so criticizing a tone should be employed by a young man in reviewing the work of so experienced and painstaking a geologist as Professor Crosby. It must, however, be exceedingly gratifying to the latter to see that his work, much of it done many years ago, when knowledge of geologic structure was far less advanced than at present, has stood so successfully all critical tests of recent years, and remains still *the* authority.

S. L. W.

A Text-book of Sanitary and Applied Chemistry. By E. H. S. BAILEY. New York, The Macmillan Company. Price, $1.40.

The author states that the object of this work is to furnish a text-book upon applied chemistry that is suitable for use by those students who have had a good high school course in general chemistry. Scattered material is also presented from government reports and other sources which has been added with the intention of making the book useful for reference. Part I. is entitled 'Sanitary Chemistry' and deals with: The Atmosphere, Fuels, Heating and Ventilation, Lighting, Water and its Purification, Sewage and its Disposal, Soap, Disinfectants, etc.

Under Part II. is considered the 'Chemistry of Foods.' Stress is laid upon the vitiated character of 'ground air,' and it is further noted how small is the attention given by the general public to the question of good ventilation, the reason being that the ills arising from a poor air supply are slow in making their appearance.

Under each heading there are experiments introduced with the view to fix in the student's mind the important points covered by the general text. In some cases, however, it is difficult to see the value of these experiments. Thus, those under Water are qualitative only. Surely the results of a water analysis can scarcely be of service unless stated in a quantitative form. The field covered by the work is so very great that it is hardly to be expected that thoroughness can be attained in a book of 345 small pages. We find, for instance, Mineral Waters, Potable Waters, Drinking Water and Disease and the Purification of Water Supplies covered in twenty-three pages, while only seven are given to Sewage Disposal.

There are many things in the book which will interest the student reader, but he must remember that it is essentially elementary. Doubtless the author intended that it should be so considered. X.

SCIENTIFIC JOURNALS AND ARTICLES

The Psychological Clinic, a journal for the study and treatment of mental retardation and deviation, by Professor Lightner Witmer,

of the University of Pennsylvania, is announced. It will be published monthly, beginning in March, except during the summer months, each volume containing about 300 pages. "*The Psychological Clinic* will be devoted primarily to the study and treatment of mentally and morally deficient children, but this will not preclude the consideration of other types deviating from the normal child, nor yet of that hypothetical type, the so-called normal child. The methods of clinical psychology are necessarily invoked wherever the status of an individual consciousness is determined by observation and experiment, and pedagogical treatment applied to affect a change, *i. e.*, the development of such individual mind. Whether the subject be a child or an adult, the result of examination and treatment may be conducted and expressed in the terms of the clinical method. Thus, the phenomena of adolescence, of criminality and insanity, are best investigated by the clinical method. The neurologist and psychiatrist are just awakening to a realization of the psychological and pedagogical significance of the treatment usually prescribed in cases of hysteria, psychasthenia, aphasia and allied mental disorders."

SOCIETIES AND ACADEMIES

THE AMERICAN MATHEMATICAL SOCIETY

The one hundred and thirty-second meeting of the society was held at Columbia University on Saturday, February 23. President H. S. White and Vice-President P. F. Smith occupied the chair at the two sessions. Thirty-three members were present. The following new members were admitted to the society: Professor T. M. Focke, Case School of Applied Science; Dr. D. C. Gillespie, Cornell University; Professor C. C. Grove, Hamilton College; Professor T. W. Palmer, University of Alabama; Professor N. A. Pattillo, Randolph-Macon Woman's College; Mr. F. D. Posey, University of Chicago; Miss Gertrude Smith, Vassar College; Dr. A. L. Underhill, Princeton University. Ten applications for membership were received.

Professor J. H. Tanner was elected treasurer of the society, to succeed Dr. W. S. Dennett, who retires after seven years' service. Professor E. H. Moore, who has been editor-in-chief of the *Transactions* since the founding of that journal in 1899, retires from the editorial committee at the completion of the present volume. The vacancy in the committee was filled by the election of Professor Maxime Bôcher. Appropriate resolutions expressing the society's grateful appreciation of the services of these retiring officers were adopted.

A standing finance committee, consisting of the treasurer, Professor Brown, and Dr. Dennett, was established to have charge of the investment of the life-membership and surplus funds of the society. For the better regulation of the presentation of papers, it was ordered that papers should hereafter be read in the order and at the session announced on the printed program, except that papers whose reading is postponed may be read at the close of a session. Papers not on the printed program, but accepted for presentation, will be read at the close of a session after the printed list is exhausted. Abstracts of papers will hereafter be included in the printed program if furnished at least three weeks in advance of the meeting.

The Annual Register of the society, containing the list of officers and members, constitution and by-laws, reports of officers, catalogue of the library, etc., has recently been issued. Copies can be obtained from the secretary.

The following papers were read at this meeting:

R. D. Carmichael: 'On dividing an angle into parts having the ratio of any given straight lines.'

R. D. Carmichael: 'A table of multiple perfect numbers.'

G. A. Miller: 'The groups generated by three operators each of which is the product of the other two.'

R. P. Stephens: 'On a quintic with three parallel tangents in any direction.'

E. B. Wilson: 'On the revolutions of a dark body about the sun.'

C. N. Moore: 'On the introduction of convergence factors into summable series and summable integrals.'

G. A. BLISS: 'The construction of a field of extremals about a given point.'

R. G. D. RICHARDSON: 'Differentiation and integration of definite integrals.'

E. R. HEDRICK: 'On a final form of the theorem of uniform continuity.'

R. D. CARMICHAEL: 'On the classification of quartic curves possessing fourfold symmetry with respect to a point.'

The San Francisco Section met on the same day at Stanford University. The Chicago Section will meet at the University of Chicago on Saturday, March 30. At the next meeting of the society, on Saturday, April 27, Professor W. F. Osgood will deliver his presidential address, postponed from the annual meeting. The subject of the address is 'The Calculus in Colleges and Technical Schools.'

F. N. COLE,
Secretary

SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE

THE nineteenth meeting of the Society for Experimental Biology and Medicine was held in Schermerhorn Hall, Columbia University, in New York City, on Wednesday evening, December 19, 1906, The president, Simon Flexner, was in the chair.

Members present.—Auer, Beebe, Burton-Opitz, Calkins, Davenport, Emerson, Ewing, Flexner, Foster, Gies, Hatcher, Lusk, Mandel (A. R.), Meltzer, Meyer, Morgan, Noguchi, Norris, Sherman, Shaffer, Torrey, Wolf, Yatsu.

Members elected.—Alexis Carrel, Winfield S. Hall, William Ophüls, H. Gideon Wells.

Abstracts of Original Communications[1]

An Experiment on the Localization Problem in the Egg of Cerebratulus: NAOHIDÉ YATSU.

The author found that the third cleavage does not always separate the entodermic stuff from the ectodermic, so that the embryo from the animal half sometimes invaginates and sometimes does not. But in shifting the third cleavage plane to the equator by compressing the egg immediately after the first division (in doing this, the second cleavage is suppressed until pressure is relieved, the third cleavage of the normal egg appearing next to the first) and in separating the animal half from the vegetative, the former always gave rise to an embryo without gut, anenteron. From this it may be concluded that in the egg of *Cerebratulus lacteus,* a little before or at the time of the third cleavage, the entodermic basis extends farther above than that of *Cerebratulus marginatus.*

Experiments upon the Total Metabolism of Iron and Calcium in Man: H. C. SHERMAN.

Each of the experiments was of three days duration and the same healthy man served as subject, throughout. On a diet of crackers and milk which furnished 0.0057 gram iron and 2.65 grams calcium oxide (Exp. I.), there was equilibrium with respect to iron, and a storage of calcium. When the diet consisted of crackers and egg-white with 0.0065 gram iron and 0.14 gram lime (Exp. II.), or of crackers alone with 0.0071 gram iron and 0.13 gram lime (Exp. III.) there were losses of both iron and calcium. These losses occurred through the intestine, but were evidently not due to intestinal putrefaction, since the ratio of sulphur in ethereal to that in simple sulphates in the urine was determined in Exp. III. and found to be as 1 : 25. The results appear to confirm the suggestion of Von Wendt that a deficiency of calcium in the diet may lead to a loss of iron as well as of calcium from the body. There was a slight tendency toward diarrhœa in each of the periods in which loss of iron and calcium occurred. The iron requirement evidently varied greatly, the average daily output for three experiments being 5.5, 8.7 and 12.6 milligrams, respectively. The lime requirement was found in further experiments (IV. and V.) to be about 0.75 gram of calcium oxide per day.

The Cause of the Treppe: FREDERIC S. LEE.

The treppe is usually ascribed to increased irritability caused by activity. The cause of the increased irritability has remained obscure. In studying the depressing action on muscle

[1] The abstracts presented in this account of the proceedings have been greatly condensed from abstracts prepared by the authors themselves. The latter abstracts of the communications may be found in number two of volume four of the society's proceedings.

of its fatigue substances the author often observed augmentation of activity instead of depression. A more careful investigation of this phenomenon shows that it may be produced by all of the three recognized fatigue substances, namely, carbon doxide, mono-potassium phosphate and paralactic acid. When a muscle is irrigated with an indifferent fluid containing one of these substances in small quantity, and compared with its mate irrigated only by the indifferent fluid, a fatigue record being made from both, more intense contractions frequently occur in the poisoned muscle at the beginning of the experiment, and may last until exhaustion sets in. When a fatigue record is being made from a muscle with the circulation intact, intravenous injection of a fatigue substance causes augmentation of contraction. The author concludes that the treppe is due to the augmenting action of fatigue substances in small quantities —the same substances which in larger quantities cause depression or fatigue.

An excellent mode of demonstrating the augmenting action of CO_2 in the cat is to record the contractions of the tibialis anticus in the living animal, and while the record is being made, to clamp the trachea. A marked treppe follows.

If two corresponding muscles be compared, one with the circulation intact, and the other with its arteries ligated, the latter muscle performs more intense contractions and exhibits a more rapidly developing treppe, owing to the accumulation of fatigue substances.

The chemical theory of the treppe is able to explain several other known phenomena. The author has experimented on both frogs and cats. The augmenting action of the fatigue substances seems to be observed even when curare is employed.

The Influence of the Red Corpuscles upon the Viscosity of the Blood: Russell Burton-Opitz.

After determining the coefficient for fresh ox serum at 37° C., the serum was gradually concentrated by the addition of definite quantities of red blood corpuscles (washed). The viscosity of the 'blood' was tested after each addition of corpuscles.

The following data may serve as examples:

	Spec. Grav.	No. Red Corpuscles.	Viscosity Coefficient.
Serum	1.0248		2397.7
S + 30 c.c. corp. ..	1.0382	4,000,000	1442.9
S + 30 c.c. corp. ..	1.0467	4,700,000	1009.3
S + 30 c.c. corp. ..	1.0524	5,700,000	851.6

Thus, the increase in the number of red corpuscles caused a corresponding increase in the viscosity. It is also obvious that the red corpuscles constitute the principal factor in determining the viscosity of the blood.

A New Recording Stromuhr, with Demonstration: Russell Burton-Opitz.

The cylinder of this stromuhr is placed horizontally and carries below its floor a valve, by means of which the inflowing blood can be diverted alternately into the right or left half of the instrument. The piston within the cylinder moves back and forth, therefore, in a horizontal direction and records its movements by means of a pulley arrangement and a writing lever upon the smoked paper of a kymograph.

On account of its great sensitiveness, and the possibility of low adjustment, this stromuhr is especially fitted for measuring the blood flow in the veins.

The instrument has been used by the author in testing possible vaso-motor reactions in the pulmonary circuit. It was connected with the vein draining the middle lobe of the left lung. The nerves in the vicinity of the ganglion stellatum were stimulated. So far the experiments have given negative results.

The Influence of Gelatin upon the Viscosity of the Blood: Russell Burton-Opitz.

Solutions of gelatin (1000 : 50) were introduced intravenously after the normal viscosity of the blood had been determined. It was found that the injections resulted in a very prompt increase in the viscosity. The following data may serve as examples:

Specific Gravity.		Viscosity.	
Before Inj.	After Inj.	Before Inj.	After Inj.
1.0565	1.0543	836	772

The Hemolytic Effects of Organ and Tumor Extracts: Richard Weil (by invitation).

The author has found that the cause of the

variability in the hemolytic effect of organ extracts, which has been noted by previous observers, is the varying admixture of blood. Kidneys prepared bloodlessly, by perfusion with salt solution, are hemolytic only in very low dilution, and after a long latent interval. Kidneys suffused with blood are, as a rule, very much more active; occasionally less so. The effects of blood have been analyzed by the separate addition of serum, emulsions of white cells (from artificial abscesses), and of red cells after washing, to the bloodless kidney extract. In each case it was found that hemolysis was inhibited. The question, therefore, arises, why are kidneys that have been suffused with blood as a rule more actively hemolytic than the bloodless organs? If their extracts are centrifuged, and all the solid particles, including the red cells, removed, it is found that the extracts are still deeply stained by hemoglobin. This is due to the destruction and solution of red cells, which is inseparable from the process of preparing the extract. The next step, therefore, was to determine the effect of adding red cell constituents to the bloodless organ extracts. This was prepared by adding red cells to distilled water, and then bringing the solution to the strength of normal salt solution. Such a solution adds very markedly to the hemolytic power of the organ extract. Its manner of action seems to resemble that of complement, inasmuch as it is capable of breaking up the red cells only after a preliminary treatment with the organ extract.

Tumors were investigated in the same manner as the kidneys. It was found that the non-necrotic tumors are somewhat more hemolytic than are the kidneys, owing possibly to their blood content. They act, however, in other ways precisely like the latter, their action being diminished by the addition of serum and of white cells, and being increased by the red cell extract.

Necrotic areas of tumors are extremely hemolytic, even up to dilutions of two in four hundred. This hemolytic activity is not affected by the addition of the blood components.

The Enzymotic Properties of Diplococcus intracellularis: SIMON FLEXNER.

The brief vitality of many of the cultures of *Diplococcus intracellularis* is a point of differential importance. Many strains, grown on a favorable medium, unless transplanted to a fresh medium, do not survive beyond two or three days. Cultures three days old show marked degenerations and the latter increase rapidly with age until, at the end of five or six days, or even earlier, no normal cocci persist. As degeneration progresses, loss of staining power and disintegration ensue, until finally, staining is lost and a formless detritus remains.

The changes in the diplococcus are associated with the action of an enzyme which brings about the disintegration. This enzyme does not exhibit the usual properties of a proteolytic ferment: it does not liquefy gelatin or coagulated serum. The degree of rapidity of its action varies with its concentration: at least a heavy suspension of the cocci in salt solution, kept at 37° C., undergoes dissolution more rapidly and completely than a weaker suspension. The vitality of the cultures is associated with the degree of autolytic alterations in the suspensions: cocci in the weak suspensions survive longer than in the stronger ones. At lower temperatures—2° C.—disintegration of the cocci either does not take place at all or progresses much more slowly. Under the latter conditions more cocci survive in the strong than in the weak concentrations, although even here the vitality is a brief one.

The enzyme of the diplococcus acts energetically upon other bacteria, bringing about their dissolution. It acts upon *B. typhosus, B. coli communis, B. pyocyaneus, B. anthracis, M. catarrhalis,* and to a less degree and more slowly upon *Staphylococcus aureus.*

On the Supposed Existence of Efferent Fibers from the Diabetic Center to the Liver: J. J. R. MACLEOD and C. E. BRIGGS.

The authors have found that no hyperglycemia is produced by stimulation of the splanchnic nerves, or of the spinal cord below the cervical region. In the cervical region, on the other hand, stimulation produces hyperglycemia except when oxygen is very freely delivered into the trachea. By such adminis-

tration it has been shown by Hirsch that the blood remains arterial even after the respiratory movements have been inhibited by curare. When the cervical spinal cord is stimulated, and especially when it is cut, the respiratory movements are very considerably interfered with so that a partial asphyxia is produced which may be the cause of the hyperglycemia.

The fact that stimulation of the cervical cord causes glycosuria can not, therefore, be taken as a proof of the existence of efferent fibers which control the glycogenic function of the liver. Dyspnea may be the cause of the hyperglycemia in these cases.

Regarding the other evidence, which is supposed to point to the existence of such fibers, the authors stated that in all the experiments on which it is based (viz., cutting the splanchnics, or sympathetic chain, or certain roots, or the spinal cord) there must have been induced by the operation, a great fall of blood pressure which, in the cases of dogs with vagal glycosuria, Macleod and Dolley have shown usually to cause a marked depression in the reducing power of the urine.

Conclusion.—When every precaution is taken to prevent asphyxia the authors have been unable, so far, to demonstrate the existence of any efferent fibers whose stimulation causes hyperglycemia.

William J. Gies,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 424th meeting was held January 26, 1907, with President Stejneger in the chair.

Mr. H. W. Clark described some observations on *Riccia lutescens* and *R. natans*. Among the many examples of adaptation in plants to alternating conditions of drouth and moisture, conditions which prevail most strikingly in temporary ponds, perhaps the most remarkable is that furnished by *Riccia lutescens*.

One of the first things to catch the eye of a visitor to the shallow woodland ponds of the northern states is a fleet of little fronds floating on the surface roughly resembling small green butterflies in general appearance. The plants would probably be found to be actively dividing into equal parts by a sort of decay along a median groove, a form of reproduction strikingly resembling that of single cells and lower organisms. Each frond has its under surface beset with long rhizoid-like scales which act as balancing organisms, so that if a frond is overturned it immediately rights itself. According to descriptions in books the plant just noticed is *Riccia* (*Ricciocarpus*) *natans*.

A visit to the same pond during the dry season would reveal numerous orbicular or elongate thalli creeping on the moist ground. These would be determined at once according to the literature as *R. lutescens*.

A third visit to the same pond some time after the rains had filled it would result in the discovery of the lately creeping fronds lifted to the surface, and in all stages of change to the floating phase. Experiments with the plants at the proper season—slowly drying basins containing floating phases, or slowly raising the water surface on the creeping phases—will result in the change of one phase to the other. These experiments might not be perfectly satisfactory, however, if attempted much out of season, for the plant has long been accustomed to making these changes at certain seasons, and would probably yield to treatment more readily at such times. About ten years ago, while attempting the experiments indicated with these plants during the spring, they fruited abundantly.

In view of these facts, one might naturally assume that *R. lutescens* and *R. natans* are different phases of the same species; this conclusion has indeed been darkly hinted at, and finally distinctly stated by one author.[1]

A visit to the marshy edge of one of our lakes or permanent ponds, however, will reveal the real *R. natans* a smaller plant than *R. lutescens*, with deep purple tinge about the edge and in the balancing scales. The balancing scales themselves are much more fully developed in *R. natans* and form a more conspicuous part of the plant as a whole.

[1] Charles E. Lewis, *Bot. Gazette*, XLI., No. 2, pp. 109–138, where a graphic account of all these changes are described and illustrated in full, and the genus is pretty thoroughly revised.

As it is, the floating phase of *Riccia lutescens* has always been identified with *R. natans* and is probably always labeled so in collections. Which species is really *R. natans* can probably only be told by examination of the type specimens. Indeed, it is likely that there are many more specimens of the floating phase of *R. lutescens* labeled *R. natans* than there are of the real *R. natans,* as the former is a much more conspicuous plant, and the latter is for various reasons much more readily overlooked. There are two distinct species in question, and each has two distinct phases.

The following brief diagnosis is, therefore, appended:

Riccia lutescens Schw., floating phase.

Thallus bright green, usually semi-orbicular to orbicular, its approximation to a complete circle being dependent on presence or absence of agitations of water-surface, waves tending to separate thalli into segments. Upper surface deeply furrowed, the main furrow functioning as the dividing line of thalli in vegetative reproduction.

Differing from *R. natans,* floating phase, in larger size, brighter green color, relatively less fully developed balancing scales, and from the fact that it is confined exclusively to temporary waters, while *R. natans* is found only in permanent waters.

Dr. W. H. Dall read 'Notes on Some Cretaceous Volutidæ,' describing the development from the Turonian upward of a group of Volutidæ which seems to have been derived from some type like *Piestochilus* Meek, to have attained a large size and striking characteristics and to have culminated in the upper Senonian or Ripley horizon in various parts of the world. The group is found represented in India, the Tyrol, North Germany and various parts of North America, represented in each region by analogous types, while each regional group has a certain local facies of its own. In North America two lines of descent were noted, represented by the genera *Volutoderma* and *Volutomorpha,* neither of which is represented in any horizon subsequent to the Ripley, though a distinct genus appears in the Tertiary of northwest America which has been more or less confused with them.

Dr. O. F. Cook read a paper on 'Parthenogenesis and Alternation of Generations in the Parasitic Hymenoptera.' The discoveries regarding the embryology of the parasitic hymenoptera presented by Dr. Howard at a former meeting of the society[1] are not merely a contribution to the study of sex-determination. They have brought to light an entirely new form of alternation of generations among the insects. Polyembryony is a botanical term which fits these zoological facts but poorly, and conceals a very close analogy with the typical and original instance of alternation of generations, that of the tunicates, described by Chamisso in 1819.

Polyembryony is the production or inclusion of two or more embryos in one set of seed-coats, instead of the usually single embryo. But it does not follow that the multiple embryos of plants are produced by vegetative propagation of the original egg or embryo, as are the chains of larvæ in tunicates and in these parasitic hymenoptera. Nor does the body of the host in which these chains of insect larvæ are formed correspond to the embryo-sac and seed-coats which enclose the multiple embryos of plants. The multiple plant embryos arise, as far as known, from the presence of two or more ova in the embryo-sacs, or from the intrusion of buds from the nucellar tissue. The polyembryony of plants has no necessary relation to sex-determination, for bisexual or hermaphrodite plants are reproduced from multiple embryos. To multiply sexually differentiated plants by vegetative propagation does not affect their sexual status, and the indications are that this is true also of animals.

Alternation of generations, that is, the alternation between vegetative propagation and sexual reproduction, has long been known among the hymenoptera. The form of alternation recently discovered in the parasitic families differs from the other in that the vegetative propagation takes place at a different period in the life history, in the early

[1] SCIENCE, December 21, 1906, 810, 'Polyembryony and the Fixing of Sex.'

larval phase, rather than in the late larval or the adult stage, as in the gall-forming hymenoptera and the plant-lice. It may be that this new method of vegetative propagation of the larvæ of parasitic insects should receive a distinct name. To call it polyembryony is to mislead all who know what is meant by polyembryony in the original application of this term among plants.

By recognizing the analogy with the previously known instances of alternation of generations among insects the new discoveries become much more interesting than when interpreted as polyembryony. These chains of larvæ correspond to the series of so-called parthenogenetic females of the gall-insects and the plant-lice, which are propagated by vegetative budding. If the fact that all the individuals of the same larva-chain are of the same sex represents a general principle of sex-determination, we must expect to find that this is also true of all the other series produced by vegetative budding. Not only will all the sexual offspring of an individual bud-propagated plant-louse be of one sex, but all the offspring which arise from each original egg of a sexual female. This would mean that what we now call parthenogenetic females are not really females, but represent the two sexes, both temporarily propagated by budding instead of by sexual reproduction. In support of this interpretation we have the fact that even the wingless, larviform, bud-producing plant-lice which are classified as the same species may show two distinct forms, as in the cotton aphis. It now becomes justifiable to suspect that these two forms may represent males and females, and that there may be explained in this way a larval dimorphism which previously appeared altogether mysterious. Adult female plant-lice are wingless, as in all the related families, but the members of these bud-propagating generations are often winged. This has made it necessary to believe that larval females might be winged while the adult females were always wingless, a unique and highly anomalous assumption which the present considerations may enable us to avoid. It is possible that the bud-producing winged insects may prove, after all, to represent the male sex, in spite of their apparent parturition.

One more confusion of terms remains to be noted. The so-called parthenogenesis of these bud-producing plant-lice is entirely distinct from the parthenogenesis of male hymenoptera from unfertilized eggs. If bud-propagation of insects is to be reckoned as parthenogenesis, then the hymenoptera have two forms of parthenogenesis, one a method of sex-determination, the other a method of vegetative multiplication. The hemiptera are now known to have a different method of sex-determination, by means of specialized chromosomes and two or more kinds of spermatozoa, so that the plant-lice should not be expected to agree with the parasitic wasps in sex-determination, even though the methods and results of vegetative propagation should prove to be entirely analogous in the two groups.

Mr. W. F. Wight read the last paper, entitled 'The History of the Cowpea and Its Introduction into America.' This will be published by the U. S. Department of Agriculture.

M. C. Marsh,
Recording Secretary

DISCUSSION AND CORRESPONDENCE

REVERSION INDUCED BY CROSS BREEDING

Dr. Castle[1] in an explanation for reversion, thinks that the wild agouti color has been introduced through the red parent (when crossed with black); and bearing on this is Dr. Davenport's explanation of reversion to Gallus bankiva color, in a cross with white and black poultry, their difference being that Dr. Castle ascribes the reversion of wild color as being added to, and Dr. Davenport as being taken from.

The latter, in his address at the New York meeting, December 28, explains the phenomena of wild color as being due to the absorption of black by the white, leaving the wild color clean. Perhaps both are right in their respective examples.

We wish to tell of some cases, wherein neither of these explanations can be applied as a cause for the reversions.

[1] Science, January 25, p. 151.

Mr. John Chalfant, of Union, Nebr., owns two sows, that from a mating with the same male farrowed seven and eight pigs, all of which bore the seven longitudinal stripes belonging to the young of the wild breeds. The parents—both sire and dams—were three fourths Berkshire and one fourth Poland China, of pure ancestry; and were all black with white points the same as the pure animals of both breeds. When these fifteen striped pigs were ten days old, we predicted to Mr. Chalfant that they would lose their stripes under three months of age, as do our wild pigs (*Scrofa*) at Bear Creek. This proved to be true. Mr. Chalfant was kind enough—at our suggestion—to mate a pair from these reversion litters; and has recently reported the progeny. We quote him verbatim:

> One of the young sows that was striped has farrowed seven pigs, as follows: two black and white spotted, with sandy stripes running lengthwise; one black, with sandy stripes; the other five—nearly black, but with solid, sandy tinge. * * * Surely this must be a reversion of a long way back.

We have here, in this one litter, near and remote reversions; representing three stages, viz., the spotted pigs, representing the Poland China of thirty years ago; the black, with sandy tinge, showing the primitive Berkshire breed of sixty years; and the longitudinal, sandy stripes are a wiping out of all color characters accumulated during domestication.

Agreeing with this is a statement of Mr. John P. Ray, of New York, in conversation with the writer. Mr. Ray originated the Silver Laced Wyandotte twenty-five years ago. Twenty-one years later, he purchased a first-prize cock that had been bred away from his own strain fifteen years. All the progeny from this cock were high-scoring and uniform; but in the product of his daughters, mated with the original strain, were nine pure whites among a hundred chicks.

Another exaggerated reversion occurred at Bear Creek, in pure Short Horn cattle. Two white calves were born, having red ears like the wild cattle of Chillingham. Their sire was a red bull and a first-strain cross between English and Kentucky families. Their dams were both of straight Kentucky strains and both red.

The patience could be overtried with instances of similar phenomena.

In the pig reversions there was a hybridizing not of color, but of chemical. The Wyandottes were of two pure strains in the same breed, and if we may judge from the reputation of their breeders, they were identical in the spots and barrings of every feather.

In the example of the 'wild-color' calves, the parents were identically red in color, were pure registered Short Horns; but three-quarter *strain* hybrids.

We can not believe that this can be accounted for, either by 'adding to' or by 'absorption'; and if your readers will kindly allow, we will propose a solution.

Surmising that heredity in the chromosome is chemic, or enzymic, and in normal line breeding this chemical is stable and repeats itself, but when precipitated by a dynamic reagent the recently acquired less stable hereditary compounds are thrown down, leaving only the old type in many instances. In other cases a new chemical arrangement is produced, as in Burbank's creations and our own swine hybrid monstrosities.

Both Castle's and Davenport's explanations seem logical to their examples, as neither experiment had reached the 'breaking up' stage, wherein we appear to get precipitated reversion.

Castle states that 'ordinary black individuals, while homozygous, are not pure in the sense that they contain no other pigment but black'; and if we understand him correctly, red or brown lies latent. If there were only color reversion, this might apply; but there are also some wonderful morphological reversions to ancestral types, that can only be interpreted as the result of a powerful detergent acting upon the later accumulations of the chromosome.

We are now experimenting with the view of learning rules of hybrid stages of reversion, whereby we can 'break up' or destroy recently acquired characters at will, when these late characters have proven undesirable.

Castle's 'fixation' is good, and the theory

may accomplish much, if he can avoid a precipitate. We hope that when he finds his discoveries are being used, 'the true scientific spirit' will yet allow him to continue his experiments and his philosophy.

Q. I. and J. P. Simpson
Bear Creek Farm

RELATIONS OF SALARY TO TITLE IN AMERICAN UNIVERSITIES

Having just read the interesting discussion in Science of February 15, under the above title, I venture to suggest that there is yet more to be said.

University men possess different kinds of value, *e. g.*: (1) Some are principally of value to the student body in attendance on their classes. (2) Some are valuable more particularly to picked individuals in the university and out of it. Such may be said in a certain sense to have as many students as those whose classes are thronged, but they are in many places. (3) Some will be exceedingly valuable to posterity, but their work is comparatively useless to the present generation, because it has not learned to value or use it, or because it will only reach its greatest significance and utility after it has been carried on for two or three generations.

From the standpoint of the state, all these classes of men are of value and should be supported. If there is any difference in their value, no doubt the pioneers, those of the third class, are the most valuable; but it requires very little reflection to see that these, from a psychological necessity, will be the *least* valued by presidents, trustees and the community at large. To properly estimate the value and importance of an 'infant industry' in the intellectual field requires imagination of such quality that those doing the work do not always possess it, and outsiders almost never.

It is quite possible to argue that the concern of the university is only with the students in attendance, so that all values must be determined by the standard applicable to the first of the above classes. This notion, however, is surely passing away, and with it the possibility of correctly estimating the money value of university men. The larger outlook also serves to convince us that the actual worth of certain professors, having in view their total influence upon contemporaries and posterity, exceeds any sum that can be thought of as payment. On the other hand, the *needs* of the great and the small are not so very diverse.

There is one kind of payment which should no doubt differ greatly according to the character of the man and his work. This is for the support of the work itself. One man may need expensive apparatus, or journeys to distant lands, while others may have no use for these things. This is not necessarily dependent in any way on the eminence of the man himself, but rather on the character of his labors; only, of course, he should be able enough to use well the means provided.

T. D. A. Cockerell
University of Colorado,
Boulder, Colo.,
February 18, 1907

SPECIAL ARTICLES

RIVER CAPTURE IN THE TALLULAH DISTRICT, GEORGIA

The head-waters of the Savannah River have been frequently referred to as an example of drainage transferred from the gulf system to the Atlantic through the process of stream capture. Dr. C. Willard Hayes, in his paper on 'The Southern Appalachians,' published as a National Geographic Monograph, cited this case as an instance of recent capture and ascribed the falls on the Tallulah River (one of the head-waters of the Savannah) to the fact that the newly acquired drainage had not been in possession of the captor sufficiently long for the falls to be worn down to grade. In a paper entitled 'Drainage Modifications' (*Jour. Geol.*, 1896) Mr. M. R. Campbell notes this capture under the heading 'remote changes shown in the streams of the Atlantic slope.' Mr. Chas. T. Simpson (Science, 1900), in discussing 'The Evidence of the Unionidae regarding the Former Courses of the Tennessee and other Southern Rivers,' reports the finding of mollusks similar to the Tennessee and Coosa River forms in the

Chattahoochee and Savannah Rivers, and mollusks of the Savannah drainage in the Chattahoochee River. From this he was led to support the theory of a capture of the upper Chattahoochee drainage by the Savannah River, since the diversion in question would effect the transferrence of fresh-water faunas from one stream to the other. A paper on 'The Geology of the Tallulah Gorge' (*Am. Geol.*, 1901), by Mr. S. P. Jones, discusses the general geology of the region, mentions the possibility of capture already suggested by Hayes and Campbell, but reaches no conclusion in regard to the matter. Other references to this capture are found in the literature, but need not be repeated here.

Believing that the upper Savannah would probably show evidence of river capture, and desiring to make a test of certain principles which had been applied in the case of the supposed capture of the upper Tennessee River with only negative results, the writer spent a month in the Tallulah district during the spring of 1905, studying the geologic and physiographic features of the district with special reference to the supposed changes in drainage. The evidence in favor of capture appeared to be quite conclusive. A detailed discussion of the various elements of the problem will be found in the *Proceedings* of the Boston Society of Natural History, Vol. 33, No. 5, but it is desired to outline certain phases of the subject here.

The results of this study appear to justify the following conclusions:

1. The upper Savannah (Chattooga) River formerly flowed southwest through the Chattahoochee River into the Gulf of Mexico, but was diverted to the Atlantic drainage by a process of stream capture, as already announced by Hayes and Campbell.

2. The capture furnishes an example of what may be termed 'remote capture,' having occurred so long ago that much of the direct evidence has been obliterated.

3. The capture seems to have resulted from the advantage gained by the Atlantic drainage over the gulf drainage, owing to the shorter course to the sea which streams of the former system enjoyed, although the process may have been aided by crustal warping.

4. The place of the capture was near the junction of the Tallulah River with the Chattooga, and probably just below that junction.

5. The falls of the Tallulah River, while initially caused by the capture, exist to-day because of a hard rock barrier crossed by the river, but not yet worn down by it.

6. The similar falls which must have existed on the Chattooga River have been obliterated by that stream, since the great lapse of time since the capture has been ample for it to grade its course in the less resistant rock over which it runs.

The Tallulah district is crossed from northeast to southwest by the southwestern extension of the Blue Ridge escarpment, which is from 500 to 600 feet high at this point. The escarpment connects a higher with a lower peneplain, both of which are eroded on folded crystallines, the higher one sloping gently toward the west, the lower one gently toward the southeast. The streams on the higher level flow in fairly mature valleys cut but slightly below the general surface. In like manner the streams on the lower level flow in broad shallow valleys; but their upper branches are working actively headward into the higher level, thus pushing the escarpment backward to the northwest, and capturing additional drainage areas from the rivers flowing on the surface well above them.

In striking contrast to these two classes of streams, on the lower and upper levels, respectively, is a drainage system cut down *into* the upper level. This is the upper Tugaloo-Chattooga River, which flows in a deep gorge cut 500 feet or more below the upper level, until it breaks from its gorge at the face of the escarpment and flows out over the lower level in a fairly mature valley. Nothing could be more striking than the contrast between this young stream with its picturesque, steep-sided chasm, cut *in* the upper level, and the mature streams in broad open valleys flowing *on* the upper and lower levels. The Tallulah River first flows through low mountains on the upper level, but when near its junction with the Chattooga suddenly plunges down into a gorge

known locally as the 'grand chasm,' and so joins the drainage system, which is cut so deeply into the upper level. The rapid descent into the chasm is made by a series of falls and rapids, known collectively as the Tallulah Falls.

In connection with this peculiar feature of the drainage, is a striking drainage pattern. The Chattooga River flows almost due southwest until it is joined by the Tallulah, and then turns abruptly at a right angle and under the names Tugaloo and Savannah Rivers flows almost due southeast into the Atlantic. Near the point where this sharp bend or elbow occurs, a stream on the upper level, Deep Creek, takes its rise and continues the southwest line begun by the Chattooga, until, under the names Soque and Chattahoochee Rivers, it reaches the gulf.

It is this assemblage of features which has suggested that the Chattooga River formerly flowed southwest into the gulf drainage, being continuous with and forming the upper part of the Chattahoochee; that one of the headwater branches of the Tugaloo-Savannah system succeeded in eating headward into the escarpment so far that it undermined the valley of the Chattooga-Chattahoochee some 500 or 600 feet above, thus diverting the upper part of that system into the Atlantic drainage, and causing it to flow down to the lower level and so on southeast to the ocean. As a result of this capture falls and rapids would be established where the descent from the higher, older course down to the lower, new course was made. These falls would be gradually worn back, leaving a young valley or gorge below them, in the vicinity of the sharp bend or 'elbow of capture' where the stream changed from the southwest to the southeast course. From the elbow of capture the remaining portion of the beheaded stream would continue its southwest course, flowing in a more mature valley on the upper level.

The features in the Tallulah district are so striking and so typical that it seems difficult to account for them on any other basis than the theory of capture. Certainly the conditions are eminently favorable for capture; and when one sees the streams on the lower level actively engaged in gnawing headward into the steep escarpment and thus undermining the upper level, he feels a growing conviction that the streams on the upper level are in imminent danger of diversion. So when he witnesses those features which must necessarily follow capture, he is not at all surprised, but adopts the theory of capture as a matter of course. There are certain features of the Tallulah district which have caused some doubt as to the efficiency of river capture, and which, therefore, deserve special attention. It would appear that if the capture is so recent that the stream has not yet had time to wear back the falls and rapids produced by capture, then there should be falls in the Chattooga River as well as in the Tallulah. The former is no larger a stream than the latter, and so far as volume goes, no better fitted to grade its course. Recency of capture, therefore, does not seem competent to explain the falls in the Tallulah, when there are no corresponding falls in the Chattooga. Mr. Jones concluded that there was no difference in the resistance of the rocks over which the two streams ran, and was, therefore, led to doubt the fact of capture, and to suggest some other alternative. Professor Davis believed that the topographic features indicated capture, and in order to account for the falls in the Tallulah and their absence in the Chattooga, suggested that the former courses of the rivers might have been such that the Chattooga was captured first, and the Tallulah not until a later period, thus giving more time for the reducing of the falls in one case than in the other.

After careful investigation it appears that the difficulty lies in the interpretation of the character of the rocks over which the two streams run. Instead of sameness of character, there is seen to be the most significant difference in composition and ability to withstand erosion and weathering. The Chattooga River flows over a mica schist, which in all parts of the region is seen to offer little opposition to stream erosion. Occasional more quartzose bands have determined the location of minor falls or rapids along the smaller branch streams, but even these small

branches of the deeply incised drainage (except in the case of the very smallest examples), have eroded deep valleys in the mica schist. On the other hand, the Tallulah River is found to cross a resistant barrier of dense, hard quartzite near its junction with the Chattooga. This rock is wholly distinct from the mica schist, contains little else than fine quartz grains firmly cemented into a massive bluish-gray quartzite. It is less apt to be sheared than the other rocks of the region, having to a great degree withstood the crushing incident to regional metamorphism; it weathers with difficulty, and wherever present forms a serious obstacle to stream erosion, even a small layer of it determining the site of falls on some of the branch streams. A great thickness of this resistant rock is crossed by the lower course of the Tallulah. A traverse of several miles along the lower course of the Chattooga resulted in the finding of nothing but mica schist in the ledges and in the boulders in the stream bed, so it seems apparent that this stream has not encountered any of this hard rock in its down-cutting, but is located wholly on the weaker mica schist.

The presence of the falls in the Tallulah River and their absence in the Chattooga now become perfectly intelligible. When the capture occurred falls were produced which at once began to be worn back. After retreating to the junction of the Tallulah and Chattooga Rivers two series of falls were formed, one retreating up the course of the former river, and one up the course of the latter. The falls in the Chattooga were worn back to grade during the long period of time which has elapsed since the capture, for the weak mica schist offered no great obstacle to the river's attempt to grade its course. The falls in the Tallulah have not been thus worn back, since the hard-rock barrier with which that stream had to contend has made the process of grading a very slow one, a retreat of but a few miles having been accomplished thus far, and the work still continuing very slowly under the extremely unfavorable conditions which prevail.

There are many direct evidences of river capture which have been obliterated during the long period of erosion since the capture occurred. The former channel of the Chattooga across the divide to the southwest cannot be seen; stream dissection has been extensive and all traces of that channel itself have been removed. The valley of the Chattooga has been so widened that no bench or terrace remains to indicate the abrupt change from the former mature upland valley to the deeply incised gorge. The lack of adjustment between the shrunken beheaded stream and the broad valley made to accommodate the former larger river, has given place to a newly established adjustment. The evidences of *recent* capture are lacking, and everything points to a great lapse of time since the capture, permitting the effacement of the more temporary effects of capture, and a considerable degree of adjustment to the new order of things. The evidences of remote capture, however, are none the less conclusive.

The theory of capture has been supported on the basis of certain facts in the distribution of the fresh-water faunas. It appears that a few shells from the Chattahoochee and more western drainage basins are found in the Savannah River, while a number of forms from the Savannah system are found in the Chattahoochee system. It is argued that these forms must have passed between the two systems at the time of capture.

That the fauna of the upper Chattahoochee (the Chattooga River) might be transferred into the Savannah River by the capture would appear quite possible. It is much more difficult to account for the transfer in the opposite direction, however, if we limit ourselves to river capture as the means. Yet the main transfer is supposed to have been in that direction. That shells could have passed from the lower level of the Tugaloo up 500 or 600 feet over falls and rapids to the higher level of the Chattahoochee, does not seem probable. It is possible, of course, that the headwater portion of the capturing stream may have been a more even slope instead of a series of falls, but the evidence of other streams working headward into the escarpment suggests that the capture was most probably initiated by a series of more or less prominent cata-

racts. These would effectually prevent transfer through the water itself. Furthermore, there is reason to believe that the transfer of water may have been nearly or quite completed before an actual surface valley connection was formed, since (as Lane has pointed out) leakage through the rocks from the higher to the lower level will go on for a long time, possibly increasing until all of the water from the higher level passes underground to the lower stream, leaving a dry channel for some distance below the point of capture in the upper valley. Under these circumstances it would be difficult to conceive of any transfer of faunas from the lower to the higher stream which was dependent upon direct fresh-water communication. On the other hand, there are so many means for the dispersal of fresh-water shells, and the evidence in other localities is so conclusive that they have been dispersed by such means, that we may reasonably suppose shells from either of the two systems might be transferred to the other independently of the capture. For this reason I do not believe that the distribution of the shells can be urged as a proof of capture, although the fact of capture is well attested by other lines of evidence.

The conclusion in favor of the theory of capture is further confirmed by the presence of old river gravels along the former southwestward course of the Chattooga. In view of the fact that the capture occurred at a remote period, we should not expect to find the former channel preserved, nor to find the gravels deposited by the river along that channel in their proper place. The stream dissection which we have already seen destroyed all traces of the former channel, would also wash the gravels down the slopes of the growing ravines and valleys, in many cases removing them altogether, but possibly leaving remnants in specially favored spots on the slopes and in the valleys. A careful search revealed the presence of these gravels, usually as scattered pebbles and boulders on the hillsides, but occasionally as considerable patches in the bottoms of small branch valleys. There was no mistaking their character. The present stream-borne material, even in the largest of these branches, is quite angular and evidently of local origin. The gravels are beautifully rounded quartz pebbles, cobbles, and boulders, somewhat roughened where exposed to the weather for a long time, but perfectly smooth where recently unearthed. In one place they were so abundant that a farmer had made numerous large piles of them in an ineffectual attempt to clear a small plot of ground for agricultural purposes. Their occurrence, together with the unequivocal topographic evidence, would seem to remove the question of capture from the realm of theory, and place it definitely in the realm of known facts.

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Reasons for Believing in an Ether

Many scientific men who are not physicists feel an ill-defined distrust of some of the more or less complex conceptions of modern physics. They feel that the physicist has, perhaps, allowed his imagination to carry him too far and has not stopped often enough to reexamine the foundations of his faith.

Perhaps the most fundamental conception exciting some such distrust from the outside is that of the æther which is assumed to fill all space. The non-physicist who has read of the oft-repeated but entirely unsuccessful attempts to detect the 'ether wind' due to the earth's movement through space, and of the negative results of all 'direct' experiments on the æther, begins to feel that the builders of physical theory are perhaps unreasonably tenacious of an idea which could, perhaps, best be dispensed with.

It may not be out of place, therefore, to state as briefly and clearly as possible several reasons for belief in an ether, reasons sufficient because based directly on observation or experiment.

The most important evidence is the simple fact that *the velocity of light does not depend on the velocity of the source.* This is shown by the normal apparent shape of the orbits of binary stars, which, it is easy to see, would otherwise appear distorted. For, if the orbital velocity of one member of a binary star

affected the velocity of its light, it would affect the time required for the light to reach us and would, therefore, change the apparent position of the star at any instant. The resulting distortion, which in some cases would be great, has been carefully looked for but has been found absent.

Thus it is a fact founded on observation that the velocity of light is independent of the source. The meaning of this fact can be made clear in the following way. Suppose an observer imprisoned in a windowless box which is thrown at random into space. Such an observer, meeting no experimental difficulties, could discover and accurately define his speed through space by simply measuring the velocity of light in various directions within his enclosure, and this, be it noted, without any reference whatever to any outside body. In general, he would find that light travels faster across his box in one direction than it does in another, for, as we have seen, the real velocity of light in space is not affected by the motion of the light source which he carries, and hence a change in his motion would change the apparent velocity of light within his box.

Thus space possesses what we might call a 'positional' property, by means of which the magnitude of any motion can be defined without reference to any body in the universe, and this motion is what physicists call 'motion with respect to the ether.'

There is an entirely different experimental truth which leads to the same conclusion as the above.

It is a generally accepted truth that two similarly charged bodies when moved side by side have, superimposed upon their mutual repulsion, an attraction which depends upon the fact that when moving they act like two parallel electric currents. This follows from Roland's classical experiment.

Now if the two charges, stationary with respect to each other, are considered alone in space, it is evident that they furnish our imprisoned experimenter another means of finding his motion relative to space, for the strength of the above-mentioned attraction depends only upon this absolute motion. This leads to the same conclusion as formerly, that space has a 'positional' property.

Other evidence of a similar kind might be given, but the above is sufficient to make it clear that at least so far as it represents this positional property of space the conception of an ether is thoroughly legitimate.

A being from a planet which possessed no atmosphere, if he came to earth, might first become conscious of our atmosphere through feeling it set in motion relatively to himself when he moved. In a somewhat similar way the ether manifests itself, since we know it through its motional property.

We are conscious of matter only as a collection of properties and one of these properties certainly is that it is capable of marking position. Therefore, the unknown reality, which exhibits this positional attribute in space as one of its properties, can be said to resemble matter to this limited extent at least, and upon this sure foundation can fitly be based the physicist's conception of an ether.

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NOTES ON ORGANIC CHEMISTRY

GLYOXAL

THE properties of the substance known as glyoxal, which is the simplest dialdehyde, certainly do not accord with its formula, OCHCHO. Some text-books try to evade this difficulty by describing it as 'a hydrate,' but this, to say the least, is hardly satisfactory. The matter has been cleared up very completely by a recent paper of Harries and Temme.[1] Glyoxal is found to exist in four forms: (1) Monomolecular glyoxal, OCHCHO, which is unstable and is described more fully below. (2) A trimolecular modification $(C_2H_2O_2)_3$, which is a colorless, pulverulent solid, readily soluble in water. It forms no characteristic derivatives, *i. e.*, reagents give with it only derivatives of (1). (3) Paraglyoxal $(C_2H_2O_2)_x$, a white powder, insoluble in water. (4) The ordinary form of glyoxal, now termed polyglyoxal $(C_2H_2O_2)_n$, which has been known during the past fifty years.

[1] *Ber. d. Chem. Ges.*, **40**, 165 (1907).

Monomolecular glyoxal is prepared by distilling a mixture of commercial glyoxal (4) with phosphorus pentoxide, and cooling the distillate by means of solid carbon dioxide and ether. Care must be taken to avoid the presence of moisture in the apparatus. The compound crystallizes in yellow prisms or spangles, becomes opaque at 10°, melts at 15° and boils at 50°. The vapor is intensely emerald green and condenses to a liquid which is at first green; as this is cooled it becomes yellow and, at very low temperatures, colorless. The vapor has an odor like that of formic aldehyde, but as inhalation continues the smell becomes sweet and not disagreeable. It burns with a violet flame and forms with air a mixture which explodes violently on the application of a flame. Glyoxal changes spontaneously into paraglyoxal (3) in a few hours, but on the addition of a *little* water the transformation is instantaneous. If, however, glyoxal be *added to a large* volume of water it dissolves with a hissing noise and the resulting liquid, which has a decidedly acid reaction, consists of an aqueous solution of monomolecular glyoxal (1). The glyoxal volatilizes with the steam when the solution is boiled. The solution readily reduces ammoniacal silver nitrate solution, but not Fehling's solution, in which latter respect it resembles the poly- and para-modifications.

Trimolecular glyoxal (2) is readily prepared by treating cinnamic aldehyde, $C_6H_5CH:CHCHO$, with ozone. The resulting ozonide, when mixed with water, gives hydrogen peroxide, benzoic aldehyde (or benzoic acid) and the glyoxal. The reaction may be represented by the formula,

the dotted lines showing the positions at which cleavage occurs.

The intense color of glyoxal is very interesting, the simplest diketone, diacetyl, $CH_3COCOCH_3$, is also strongly colored, whereas oxalic acid, HOCOCOOH, is absolutely colorless, yet all three substances possess in common the grouping OCCO, in one case united with hydrogen or methyl (colored), in the other combined with hydroxyl (colorless). It is tolerably certain that, of the compounds consisting only of the elements carbon, hydrogen and oxygen, glyoxal is the simplest one to exhibit color.

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Current Notes on Meteorology and Climatology

Hail-shooting—the question settled

It may be remembered that the 'hail-shooting' campaign in Europe was made the subject of a conference held at Graz in 1902. This body concluded that the results up to that time had been negative, and the hope was expressed that the experiments might be continued and carefully watched. The Italian Minister of Agriculture appointed a commission to undertake new experiments, under the presidency of Senator Blaserna. After a study of the results during the period 1902–1906 the conclusion reached by the Commission (*Att. dei Lincei*, 1906, II.; *Ciel et Terre*, January 16, 1907, 591–592) is that the five-year period has yielded an absolutely negative result. The commission reports that there is no hope of preventing damage by hail by means of the so-called 'hail-shooting,' and that protection must be sought along wholly different lines. The question may now be regarded as definitely settled.

Tropical cyclone tracks

We had occasion recently to call attention in these columns to a report by A. Schück, entitled 'Zur Kenntniss der Wirbelstürme' (Hamburg, 1905). A second report on the same subject has since been issued (dated 1906), presenting, in elaborate detail, the facts now at hand regarding the tracks of tropical cyclones in the West Indies, the Indian Ocean, and in the Pacific. Dr. Schück has made search through all available literature, and has plotted the tracks so far as known, on numerous charts. In future all students of cyclonology will need to refer to Schück's work.

THE BRÜCKNER PERIOD OF RAINFALL AT RIO DE JANEIRO

A RECENT study of rainfall at Rio de Janeiro, summarized in the *Meteorologische Zeitschrift* for January, 1907, shows that a thirty-five-year periodicity seems to prevail there. It is interesting to observe the increasing number of cases of periodicity in climatic averages which fall in line with the Brückner period. An important difference between the original work by Brückner and these later investigations is, however, this: that Brückner started on his quest without prejudice in favor of any particular period, while the more recent students of the same subject have naturally been prejudiced by the conclusions reached by the author of the now famous 'Klimaschwankungen seit 1700.'

METEOROLOGICAL PHENOMENA OF VOLCANIC ERUPTIONS

THE inflowing air currents towards volcanoes which are in active eruption, and the local whirlwinds which are sometimes generated in these currents, have been described by several writers. During the last eruption of Vesuvius (April, 1906), as pointed out by W. H. Hobbs (*Journ. Geol.*, 1906, 636–655) the windows of some houses were broken on the side away from the mountain. This is explained as having been due to the strength of the air currents which were moving towards the volcano.

TREE-PLANTING FOR SNOW-BREAKS

TREE-PLANTING has been begun along the western lines of the Canadian Pacific Railway. Over one hundred miles of trees are to be planted between Calgary and Winnipeg for snow-breaks. Experiments are to be made with tamarack for use as ties, and plantings of jack pine and tamarack are to be started at Medicine Hat in this connection.

NOTE

THE general title under which these 'Notes' have been printed since 1896 is changed with the present number of SCIENCE from *Current Notes on Meteorology* to *Current Notes on Meteorology and Climatology*. The latter title expresses more clearly the scope of the subjects which are here included, and gives deserved prominence to the geographical aspects of meteorology which are properly embraced in the term climatology.

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PHOTOGRAPHS OF FAINT STARS[1]

THE number of facts now being accumulated by means of photographs of the stars is enormous. Unfortunately, only a small portion of these facts is now available, and therefore of any use to science. This applies particularly to the faint stars. Many photographs are taken by professional and amateur astronomers, which are followed carefully during long exposures with telescopes having large apertures. In some cases, several hundred thousand stars appear upon a single plate. Unfortunately, no record has been published of many of these photographs, and therefore no use can be made of them. It is the object of the plan described below to remedy this difficulty.

The Harvard collection of photographs in part supplies this need, for stars of the thirteenth magnitude and brighter. On the average, this collection contains images of all the stars of the fifth magnitude and brighter on over a thousand nights. The number of these stars is about two thousand, the photographs are distributed throughout the last twenty years, and cover all parts of the sky. For stars of the twelfth magnitude, which can be taken with a lens of one-inch aperture and an exposure of one hour, the number is reduced to five hundred. This includes the stars in the Harvard Map of the sky, about two million in number. There are about five million stars of the thirteenth magnitude and brighter. They appear on plates taken with eight-inch doublets, and having exposures of ten minutes. About two hundred images of each of these are contained in the Harvard collection. For fainter stars, the number of images falls off very rapidly. Stars of the

[1] Harvard College Observatory, Circular 123.

fourteenth magnitude would appear on plates, having exposures of ten minutes, taken with the twenty-four-inch Bruce telescope, and on plates, having exposures of an hour, taken with the eight-inch telescopes. The average number of times the whole sky is thus covered does not exceed three or four. A large part of the southern sky is covered by plates having an exposure of an hour or more, taken with the twenty-four-inch Bruce telescope. One hundred and sixty regions, covering a tenth of the sky, have exposures of four hours. While, therefore, material exists for studying the variability of stars of the thirteenth magnitude or brighter, but few images can be found of stars much fainter than this limit, except in special regions like the Nebula of Orion. This limit could probably be extended nearly two magnitudes, if the following plan could be carried out. For the present it seems best to confine this work to photographs having an exposure of half an hour or more, and taken with doublets whose aperture is six inches or more. Photographs taken with large reflectors or single lenses may take fainter stars, but in general they relate to special regions and except in the charts of the Astrographic Congress do not cover large parts of the sky. The latter great work will of course, eventually, furnish one or two images of all stars of the fourteenth magnitude, and brighter.

Information is frequently desired regarding very faint stars. For instance, evidence of the previous existence of a new star; of a star now missing; the position of an asteroid; the magnitude at minimum of a faint variable; early position of a faint star suspected of proper motion. Three questions suggest themselves. Where are the principal collections of photographs showing faint stars, and what is their character and extent? Does a photograph exist which is likely to contain the required information? Is this photograph accessible, so that the information desired can be secured from it? Satisfactory answers to these questions can generally be obtained for stars brighter than the thirteenth magnitude, but not for fainter stars. Astronomers having collections of photographs showing such faint stars are urged to publish the material required to answer these questions, or to send the information needed to this observatory. The principal facts desired are given below:

1. A description of the instrument, stating its location; form of lens; maker; aperture; focal length, or scale of photograph, that is, number of seconds of arc to the millimeter; size of plate, or region covered; diameter of circle over which stars as faint as the fourteenth magnitude are shown; kind of plate used; name of observer.

2. A list of photographs, which should include the number designating each plate; the time of the center of the exposure (found by adding half the duration of the exposure to the time of beginning), expressed either in Julian Days and thousandths following Greenwich Mean Noon, or in calendar days, hours and minutes; the right ascension and declination for 1900 of the center of the plate; the time of exposure in minutes; the quality on a scale of 5, 5 denoting that the images are circular and that no serious defect appears upon the plate, 4 that the images are nearly circular so that their positions can be accurately measured, 3 that faint stars are shown so that the relative brightness can be accurately estimated, even if the images are not circular.

3. A statement whether the owner is willing to examine and if necessary measure his photographs to furnish any desired information; to lend them under suitable restrictions, so that copies may be made; to furnish contact prints at cost.

It is the policy of the Harvard Observatory to make the material it has collected as widely useful as possible. Accordingly, preparations are being made to publish the facts asked for in Nos. 1 and 2. For many years the observatory has offered to furnish copies of its photographs at cost to whoever might desire them. If this policy is adopted at other observatories, a purchase of large numbers of photographs of faint stars is contemplated here. The observatory will take charge, temporarily or permanently, of good photographs for which the

owners have no further use, and will render them accessible to astronomers by the methods described above.

EDWARD C. PICKERING

January 19, 1907

THE SEISMOLOGICAL SOCIETY OF AMERICA

THE Seismological Society of America was incorporated under the laws of the state of California on February 13, with a board of directors as follows: George Davidson, president; Andrew C. Lawson, 1st vice-president; T. J. J. See, 2nd vice-president; Alex. G. McAdie, 3rd vice-president; J. N. Le Conte, treasurer; Geo. D. Louderback, secretary; Chas. Burckhalter, W. W. Compbell, C. Derleth, Jr., G. K. Gilbert, A. O. Leuschner, J. S. Ricard.

A letter has been issued, which says: In October 1891 there occurred in Japan what is now historically known as the Mino-Owari Earthquake. Over 7,000 people were killed, 17,000 injured, and 20,000 buildings destroyed. This disaster so impressed the people of Japan that a national movement resulted in the formation of a large general society for the study of earthquake phenomena. An earthquake investigation committee was appointed by the emperor. This committee has already published fifty volumes in Japanese and over twenty in foreign languages. Seventy-five stations have been provided with seismographs and over 1,500 stations report. As a result, Japan is now the foremost nation in activity of earthquake investigation and in devising and applying scientific methods of protection.

The earthquake of April 18, 1906, has brought home to us also the desirability of organization for similar purposes, with the hope that our labors may ultimately be of value to the people in protecting life and property. It is in this spirit that the Seismological Society has been organized. It aims to collect accurate information concerning the mode of action and effects of earthquakes, to establish and train a corps of reliable observers throughout the country, to disseminate the truth among the people, to inform them of the methods devised in various countries to protect life and property, to supplant any element of terror or helplessness which results from imperfect knowledge by an interest in natural phenomena and a sense of security resulting from familiarity with the facts and the taking of reasonable precautions.

To be of general benefit the society must have a large membership, and the dues ($2.00 per year, life membership $25.00) have been placed low for this purpose. The society will inform its members from time to time as to the progress of its work and hopes in the near future to establish a regular series of publications.

Those who are in sympathy with the objects of the society are requested to communicate their desire for membership by writing to the secretary, Professor George D. Louderback, University of California, Berkeley, Cal.

SCIENTIFIC NOTES AND NEWS

A SPECIAL act of congress, passed on February 27, authorized the president to appoint Lieutenant and Assistant Surgeon James Carroll, U. S. Army, a surgeon with the rank of major, in recognition of his important experimental work on yellow fever. The president at once approved this bill and sent the nomination to the senate, and it was confirmed promptly, so that Dr. Carroll is now a major in the Medical Department of the Army.

DR. FREDERICK REMSEN HUTTON, for thirty years adjunct professor and professor of mechanical engineering at Columbia University and for six years dean of the faculty of applied science, will become professor emeritus on July 1 next. A suitable tablet commemorating Professor Hutton's services will be placed in the mechanical engineering laboratory.

PROFESSOR LE ROY C. COOLEY will retire from the active duties of the chair of physics of Vassar College at the end of this year.

PRINCE ROLAND BONAPARTE has been elected a member of the Paris Academy of Sciences in the room of the late M. Bischoffsheim.

MR. JOHN HAYS HAMMOND has been nominated president of the council of the Amer-

ican Institute of Mining Engineers, which will hold its next meeting in New York City during April.

The sum of about $16,000 has been subscribed toward purchasing the homestead of Mr. Alexander Graham Bell at Bradford, Ontario.

Captain Amundsen, the Norwegian explorer, who recently sailed through the Northwest Passage in the *Gjoa,* has lectured before several Paris scientific societies and has been made commander of the Legion of Honor. Captain Amundsen expects to visit the United States in the autumn.

Mr. Frank M. Chapman, curator of ornithology of the American Museum of Natural History, is engaged in making a collection for the museum of southern birds, especially of white herons in various stages of development.

A grant of $500 has been made from the Hodgkins fund of the Smithsonian Institution, to Professor R. von Lendenfeld, of the Royal Zoological Institute at Prague, for an investigation of the organs of flight of Lepidoptera, Hymenoptera and Diptera. In this investigation the wings of the insects will be considered in their relation to mechanical flight, as well as from a purely morphological point of view.

The Carnegie Institution has renewed its grant of $1,000 to Professor Haskins, of Harvard University, for the exploration of documentary materials for Anglo-Norman history.

Mr. J. A. Fleming, of the department of terrestrial magnetism of the Carnegie Institution of Washington, is at present engaged in making magnetic observations in Central America.

Dr. Bradley M. Davis has resigned from the botanical department of the Marine Biological Laboratory and Dr. George T. Moore will be in charge next summer. Dr. Moore may be addressed at West Chester, Pa., until June 1, and after this date at Woods Hole, Mass.

President Eliot spoke before the Canadian Club of Montreal, on February 22, on 'Advantages of Variety in Experiments on Free Government.' On the same day he spoke at the annual dinner of the American University Men's Association in Montreal. On February 23 he spoke before the Canadian Club of Ottawa on 'The Way of Escape from Competitive Armaments.'

At Brown University lectures have been given by Professor Josiah Royce, of Harvard University, on 'Provincialism,' and by Professor E. C. Sanford, of Clark University, on 'The Rôle of the Different Senses in Mental Life.'

Professor E. F. Nichols, of Columbia University, lectured on March 12, before the Middletown Scientific Association, his subject being 'The Pressure due to Radiation.'

The Society for Ethical Culture has arranged for a course of free lectures on 'The Mental Life of Animals' to be delivered at the Ethical Culture building, Sixty-third Street and Central Park West, on the following dates: March 6—'The Behavior of the Lower Animals,' Professor H. S. Jennings, Johns Hopkins University; March 13—'Some Remarkable Instincts of Ants,' Professor W. M. Wheeler, American Museum of Natural History; March 20—'The Behavior of the Higher Animals,' Professor E. L. Thorndike, Teachers College, Columbia University. The lecture begins at 8:15 P.M.

In view of the death of Professor Charles Edward Garman, of Amherst College, Professor Frederick J. E. Woodbridge, of Columbia University, will give a series of lectures before the department of philosophy during the spring term.

Professor John Krom Rees, since 1881 professor of geodesy and astronomy and director of the Observatory of Columbia University, died on March 9, in his fifty-sixth year. Professor Rees had been ill for several years and had recently been made professor emeritus.

Professor Henry Davis Todd, U. S. N. (retired), died at Annapolis, on March 8, at the age of sixty-nine years. Professor Todd served through the civil war with distinction and became head of the Deparment of Physics

and Chemistry at Annapolis in 1878. From 1886 to 1899, he was assistant on the Nautical Almanac, and was director from 1899 to 1900, when he was retired.

M. HENRI MOISSAN, professor of general chemistry at the Sorbonne and director of the Institute of Applied Chemistry, known especially for his work on fluorine and with the electric furnace, died at Paris, on February 20, at the age of fifty-five years.

DR. SCHREIBER, of the Russian Army, died at Kronstadt on March 7, from the bubonic plague, which he contracted while carrying on experiments with bacilli at the Alexander Laboratory. Dr. Pedlevsky, who was working in the same laboratory, has also contracted the disease.

Dr. Alfred Kirchhoff, emeritus professor of geography, University of Halle, died on February 8, aged sixty-eight years.

The death is announced of Mr. Henry Chamberlain Russell, F.R.S., government astronomer of New South Wales since 1870, at the age of seventy-one years.

THE New York assembly on March 5 passed the Young bill, which provides for the establishment of a nautical museum and observatory in Bronx Park, New York.

PRESIDENT ROOSEVELT on March 2 signed proclamations creating or increasing thirty-two forest reserves in various western states. The agricultural appropriation bill, then pending, contained a provision that such reserves should not be established except by act of congress. The president believed that if such a law were made, important timber lands would be largely dissipated before congress had an opportunity to consider the matter, while under the action taken they will be preserved. In a memorandum he says that these reserves were determined on and the preparation of the necessary papers ordered some months ago—in two thirds of the cases some years ago.

AN expedition from the Desert Laboratory of the Carnegie Institution of Washington conducted by Dr. D. T. MacDougal has recently circumnavigated the Salton Sea in a sail boat. This lake was found to have a length of over fifty miles and an area of nearly seven hundred square miles. Although the break in the banks of the Colorado River from which the main channel leads to the lake was closed on February 10, yet minor channels and seepage poured sufficient water in the lake to maintain its level during the month following at the maximum depth. It is therefore to be expected that the present level may be retained for some time, and that the evaporation may not exceed the inflow by as much as fifty inches during the present year. Five stations were located and surveyed for the study of the reoccupation of the basin by vegetation as the lake recedes. A second sunken basin south of the Salton and lying between the Cucopa Mountains and the main range of Baja California in Mexico was traversed by wagon, skirting the shores of a lake which partially fills it. This basin seems to be subject to more frequent overflow from the delta, and during 1905 a lake thirty miles long and fifteen wide was formed, which has now shrunken to a third of the dimensions given. Some important material and data bearing upon the plants and animals living in saline waters, hot springs and clay deserts were obtained.

THE Seventh International Zoological Congress, to be held in America, has established a section of heredity. Dr. Chas. B. Davenport, Cold Spring Harbor, L. I., N. Y., as secretary of this section, solicits from investigators in the subject, titles of papers which they would like to present to the section.

THE next meeting of the American Electrochemical Society will be held at the University of Pennsylvania on May 2, 3 and 4, under the presidency of Mr. Carl Hering.

THE second congress of the International Surgical Society will be held in Brussels in September, 1908, under the presidency of Professor Czerny of Heidelberg.

ACCORDING to press dispatches the Argentine Antarctic ship *Uruguay*, which left Buenos Ayres on January 29, 1906, has arrived at Scotia Bay, South Orkney Islands, after a perilous voyage, during which she encountered

hundreds of icebergs and heavy pack-ice and sustained considerable damage. The Scotia Bay station was established by the Scottish Antarctic expedition of five years ago, and was taken over in 1905 by the Argentine Government, which is continuing the meteorological and magnetic observations begun by the Scottish expedition.

The Journal of the American Medical Association states that it is almost settled that the Ontario Medical Library Association, the Toronto Clinical Society, the Toronto Medical Society and the Toronto Pathological Society will merge into the Academy of Medicine, Toronto. The academy will be managed by a council of twelve, and the first council will be composed of the officials of the Ontario Library Association and the presidents and secretaries of the other three societies. These will choose their own officers, while succeeding councils will be composed of nineteen members. The academy has a house in Queen's Park, and a library and auditorium to cost $50,000 will be added. Dr. J. F. W. Ross is president of the Ontario Medical Library Association; Dr. H. B. Anderson, of the Toronto Clinical Society; Dr. R. D. Rudolf, of the Toronto Medical Society, and Dr. J. A. Amyot, of the Toronto Pathological Society.

UNIVERSITY AND EDUCATIONAL NEWS

Columbia University has received a gift of $30,000 from an anonymous source to be used for pressing needs of the university.

Mr. Andrew Carnegie has offered $50,000 toward the building fund of the McGill University College of British Columbia, conditional on a similar sum being collected.

Announcement is made that a graduate school of agriculture will be conducted at Cornell during the summer of 1908, under the management of the Association of American Agricultural Colleges and Experiment Stations. Sessions were held at the Ohio State University in 1904, and at the University of Illinois in 1906.

Various bills have been introduced in the Massachusetts legislature, which would tax the residences of college and university professors owned by the institutions. One of these bills provides for reimbursing the town or city by the state. President Eliot and other representatives of universities and colleges were expected to appear before the legislative committee on taxation on March 13.

A course in anthropology was offered at Minnesota for the first time last autumn by Professor A. E. Jenks, then beginning work in the department of sociology, and it was elected by six students. The course was offered again the second semester, beginning on February 4, and has been elected by eighty-three students. An advanced course was also offered the second semester which has been elected by eighteen students.

The trustees of Columbia University at their last meeting promoted a number of officers of instruction, including the following: From adjunct professor to professor—Earl B. Lovell, civil engineering; Henry C. Sherman, chemistry. From lecturer to professor—Dickinson S. Miller, philosophy. From instructor to adjunct professor—William Campbell, metallography; William P. Montague, philosophy; James H. McGregor, zoology. From tutor to instructor—Tracy E. Hazen, botany; Floyd J. Metzger, chemistry; Charles P. Berkey, geology; Bergen Davis, physics; Cavalier H. Jouet, chemistry; Victor J. Chambers, chemistry. From lecturer to tutor—Samuel R. Williams, physics; Pauline H. Dederer, zoology. From assistant to tutor—William N. Berg, physiological chemistry; Marion E. Latham, botany.

Mr. William Spens, B.A., has been elected director of natural science studies and fellow of Corpus Christi College, Cambridge.

Professor Josef Pompeckj, recently called to Königsberg, has now accepted the chair of geology and mineralogy at Göttingen, as successor of Professor von Koenen.

Errata: In Science xxv., p. 293, second column, the fourth word of line 12 should be *spikelets,* the fifth word *ligule.* In line 18, the first word should be *Commutata.*